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ABSTRACT

Five learning activity packets (LAPs) are provided for the instructional area of drive train in the auto mechanics II program. They accompany an instructor's guide available separately. The LAPs outline the study activities and performance tasks for these five units: (1) clutch assembly, (2) standard transmission, (3) drive lines, (4) rear axle, and (5) automatic transmission service. A cover sheet to each LAP sets forth purpose, an introduction, and list of tasks included. Each LAP contains these components: a checklist of learning steps, pretest (with answers), and assignment sheets (with answers). (YLB)

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State Department of Vocational and Technical Education CIMC Stillwater, Oklahoma LEARNING ACTIVITY PACKETS

for AUTO MECHANICS II

LAP NO. _____ CODE: _____

MAJOR INSTRUCTIONAL AREA SECTION C--DRIVE TRAIN

INSTRUCTIONAL UNIT UNIT I--CLUTCH ASSEMBLY

LEARNING ACTIVITY PACKET NO. 15

PREREQUISITE LAP(S) NONE

PURPOSE: This Learning Activity Packet (LAP) outlines the study activities and performance tasks for "Clutch Assembly." Accomplishing these procedures will aid the student in attaining a working knowledge of this area of training and in achieving a Skilled or Moderately Skilled competency level in the performance of jobs associated with this specialty.

INTRODUCTION: The course of study in this LAP will help the student become able to describe the construction and operation of the clutch assembly and to remove, inspect, and correctly replace a clutch assembly.

TASKS INCLUDED IN THIS LAP:

1. Adjust clutch linkage free travel.
2. Remove clutch assembly.
3. Inspect clutch assembly.
4. Check clutch housing alignment.
5. Replace clutch assembly.

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SECTION C--DRIVE TRAIN
UNIT I--CLUTCH ASSEMBLY

LEARNING STEPS

Check the following blanks as you complete the required steps.

_____ 1.	Read	Unit and Specific Objectives, page AM II-1-C.
_____ 2.	Complete	Clutch Assembly Pretest, LAP page 9.
_____ 3.	Study	The sections of the Information Sheet, pages AM II-5-C through 8-C, indicated by your instructor on your pretest.
_____ 4.	Refer	To Step 11 of your pretest. If additional study is indicated for any of Sections I, II, III, or IV, continue to Learning Step 5. Otherwise, proceed to Learning Step 7.
_____ 5.	Do	LAP Assignment Sheet #1, LAP page 15.
_____ 6.	Do	LAP Assignment Sheet #2, LAP page 19.
_____ 7.	Refer	To Step 11 of your pretest. If additional study is indicated for any of Sections V, VI, or VII, continue to Learning Step 8. Otherwise, proceed to Learning Step 10.
_____ 8.	Do	LAP Assignment Sheet #3, LAP page 21.
_____ 9.	Do	LAP Assignment Sheet #4, LAP page 23.

_____10. Refer — To Step 11 of your pretest. If additional study is indicated for any of Sections VIII, IX, or X, continue to Learning Step 11. Otherwise, proceed to Learning Step 13.

_____11. Do — LAP Assignment Sheet #5, LAP page 25.

_____12. Do — LAP Assignment Sheet #6, LAP page 29.

_____13. Check — The tasks below that you think you can perform without supervision.

Student Check			Instructor Initials/Date: Skilled	Moderately Skilled
_____	a.	Adjust clutch linkage free travel (16)	_____	_____
_____	b.	Remove clutch assembly (22)	_____	_____
_____	c.	Inspect clutch assembly (28)	_____	_____
_____	d.	Check clutch housing alignment (34)	_____	_____
_____	e.	Replace clutch assembly (40)	_____	_____

_____14. Discuss — Your competency in each task with your instructor. Your instructor will initial each task in which you demonstrate sufficient competency. If all tasks have been initialed by your instructor, proceed to Learning Step 45. Otherwise, continue to Learning Step 15.

_____15. Refer — To Learning Step 13a. If this task has been initialed by your instructor, proceed to Learning Step 21. Otherwise, continue to Learning Step 16.

_____16. Study — Job Sheet #1--Adjust Clutch Linkage Free Travel, pages AM II-21-C and 22-C.

_____17.	Watch	Slide/tape presentation, "Adjust Clutch Linkage Free Travel" (C-I-1).
_____18.	Do	Job Sheet #1--Adjust Clutch Linkage Free Travel.
_____19.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 13a and proceed to Learning Step 21. Otherwise, repeat Learning Steps 16 through 18 and then continue to Learning Step 20.
_____20.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 13a and continue to Learning Step 21. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 13a and then continue to Learning Step 21.
_____21.	Refer	To Learning Step 13b. If this task has been initialed by your instructor, proceed to Learning Step 27. Otherwise, continue to Learning Step 22.
_____22.	Study	Job Sheet #2--Remove Clutch Assembly, pages AM II-23-C and 24-C.
_____23.	Watch	Slide/tape presentation, "Remove Clutch Assembly" (C-I-2).
_____24.	Do	Job Sheet #2--Remove Clutch Assembly.
_____25.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 13b and proceed to Learning Step 27. Otherwise, repeat Learning Steps 22 through 24 and then continue to Learning Step 26.

_____26.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 13b and continue to Learning Step 27. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 13b and then continue to Learning Step 27.
_____27.	Refer	To Learning Step 13c. If this task has been initialed by your instructor, proceed to Learning Step 33. Otherwise, continue to Learning Step 28.
_____28.	Study	Job Sheet #3--Inspect Clutch Assembly, page AM II-25-C.
_____29.	Watch	Slide/tape presentation, "Inspect Clutch Assembly" (C-I-3).
_____30.	Do	Job Sheet #3--Inspect Clutch Assembly.
_____31.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 13c and proceed to Learning Step 33. Otherwise, repeat Learning Steps 28 through 30 and then continue to Learning Step 32.
_____32.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating,have your instructor initial Learning Step 13c and continue to Learning Step 33. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 13c and then continue to Learning Step 33.

_____33.	Refer	To Learning Step 13d. If this task has been initialed by your instructor, proceed to Learning Step 39. Otherwise, continue to Learning Step 34.
_____34.	Study	Job Sheet #4--Check Clutch Housing Alignment, pages AM II-27-C through AM II-29-C.
_____35.	Watch	Slide/tape presentation, "Check Clutch Housing Alignment" (C-I-4).
_____36.	Do	Job Sheet #4--Check Clutch Housing Alignment.
_____37.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 13d and proceed to Learning Step 39. Otherwise, repeat Learning Steps 34 through 36 and then continue to Learning Step 39.
_____38.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 13d and continue to Learning Step 39. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 13d and then continue to Learning Step 39.
_____39.	Refer	To Learning Step 13e. If this task has been initialed by your instructor, proceed to Learning Step 45. Otherwise, continue to Learning Step 40.
_____40.	Study	Job Sheet #5--Replace Clutch Assembly, page AM II-31-C through 34-C.

_____41.	Watch	Slide/tape presentation, "Replace Clutch Assembly" (C-I-5).
_____42.	Do	Job Sheet #5--Replace Clutch Assembly.
_____43.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 13e and proceed to Learning Step 45. Otherwise, repeat Learning Steps 40 through 42 and then continue to Learning Step 45.
_____44.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 13e and continue to Learning Step 45. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 13e and then continue to Learning Step 45.
_____45.	Refer	To Learning Step 13. If all tasks have been initialed by your instructor, continue to Learning Step 46. Otherwise, refer to the step indicated in parentheses after the unsigned task.
_____46.	Review	Information Sheet (pages AM II-5-C through 8-C) and LAP Assignment Sheets.
_____47.	Take	Clutch Assembly Test (see your instructor). If your score is 85 percent or above, continue to the next assigned Learning Activity Packet. Otherwise, ask your instructor about additional study requirements and possible retesting.

SECTION C--DRIVE TRAIN
UNIT I--CLUTCH ASSEMBLY

PRETEST

NAME _____ SCORE _____

DIRECTIONS: This pretest is to determine how much you already know about a clutch assembly. Your performance on this pretest will not be used to determine your grade in the course. Instead, it will guide your instructor in designing this course to meet your needs. If you are unsure of the answer to a question, do not guess. Guessing may prevent you from receiving needed instruction.

1. Match terms and definitions associated with a clutch assembly. Write the correct numbers in the blanks.

5 a.	Bearing located in the flywheel flange of the crankshaft which allows for correct support and alignment of transmission input shaft	1. Flywheel
6 b.	Amount of clutch pedal movement before release bearing contacts pressure plate fingers	2. Release fork
8 c.	Housing, spring, and plate assembly which provides pressure to clamp clutch disc between pressure plate and flywheel	3. Clutch disc spin time
1 d.	Heavy metal disc which has a friction surface for the clutch plate and supports all of the clutch components	4. Clutch disc
2 e.	Y-shaped lever inside clutch housing used to engage and disengage clutch	5. Pilot bearing
7 f.	Bearing which provides a method of releasing spring pressure of the pressure plate	6. Free travel
3 g.	Time it takes for the clutch disc to stop spinning after clutch release	7. Release bearing
4 h.	Plate which provides friction between pressure plate and flywheel	8. Pressure plate

2. Identify the components of the clutch assembly illustrated below. Write the correct letters in the blanks.

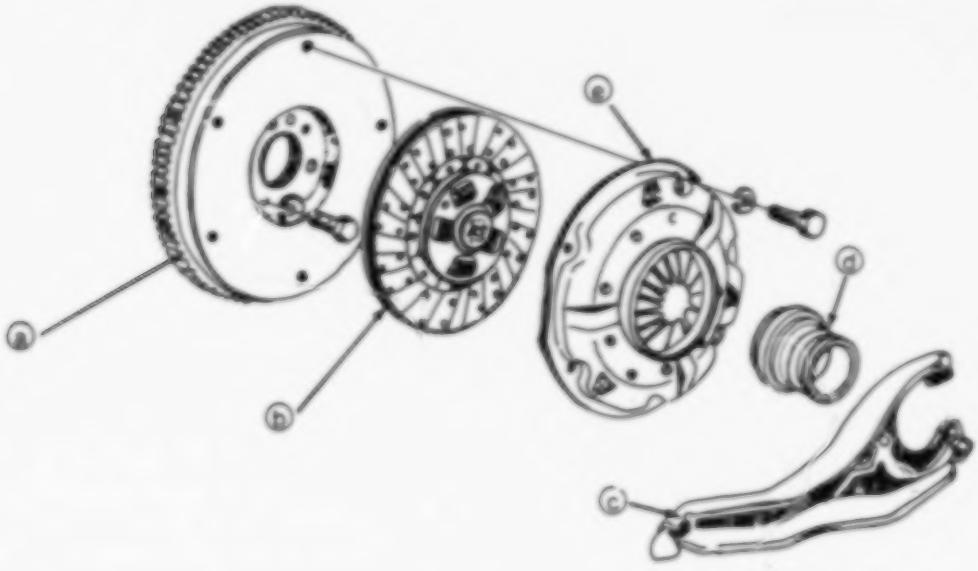
__b__ Clutch disc

__c__ Release fork

__d__ Release bearing

__e__ Pressure plate

__a__ Flywheel



3. Identify the parts of the clutch disc illustrated below. Write the correct letters in the blanks.

__e__ Torsional coil springs

__b__ Hub flange

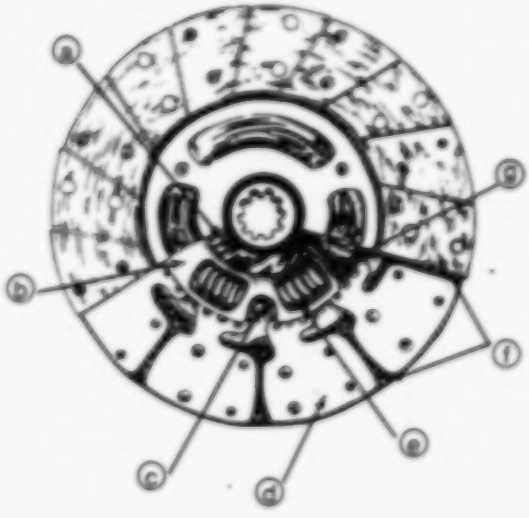
__c__ Stop pin

__a__ Friction ring

__d__ Cushion springs

__f__ Facings

__g__ Drive washer



4. List types of pressure plates.

   a. Diaphragm

   b. Coil spring

   c. Centrifugal

5. Discuss clutch operation for each of the following positions.

   a. Engaged -- Spring pressure clamps clutch disc between pressure plate and flywheel face

   b. Disengaged -- Release bearing and linkage are used to release spring pressure

6. List methods used to actuate clutch release.

   a. Links, levers, and rods connected to transfer motion from clutch pedal to release fork

   b. Hydraulic system using a master cylinder and slave cylinder to transfer motion from clutch pedal to release fork

7. Name mechanisms that allow smooth clutch engagement. Describe each mechanism in the space following its name.

   a. Cushioning device--Thin, waved cushion spring between clutch disc facings

   b. Dampening device--Series of heavy coil springs placed in the clutch disc hub to absorb shock

8. List ten conditions to look for during clutch inspection.

   ANSWER SHOULD INCLUDE ANY TEN OF THE FOLLOWING:

   a. Normal finger wear

   b. Slight chatter marks

   c. Excessive finger wear

   d. Excessive heat discoloration

   e. Excessive warpage

f. Heat cracks

g. Wear pattern from warped pressure plate or flywheel

h. Worn clutch disc

i. Loose or worn clutch disc hub

j. Worn clutch shaft spline

k. Worn pilot bearing

l. Weak pressure plate spring tension

m. Release fork pivot and finger wear

n. Notched or rough release bearing support

9. List five symptoms that may occur when the clutch housing bore has excessive runout.

a. Excessive transmission gear wear or noise

b. Transmission jumping out of gear

c. Drive line vibration

d. Clutch pedal vibration

e. Scrubby pedal feel

f. Pilot bearing noise

g. Excessive clutch spin time

10. Match clutch malfunctions and their probable causes. Write the correct numbers in the blanks.

1 a.	Oil contamination on clutch assembly; broken motor mounts; glazed clutch surface from being overheated	1. Grab
5 b.	Worn or misaligned linkage; release bearing dragging on support	2. Chatter
7 c.	Uneven pressure plate finger height	3. Bearing noise
4 d.	Pressure plate not releasing due to improper linkage adjustment; broken pivots in pressure plate	4. Drag
8 e.	Water-contaminated clutch disc rusted to flywheel and pressure plate	5. Binding
3 f.	Worn or dry pilot or release bearing when clutch is disengaged; pitted clutch shaft bearing when the clutch is engaged with transmission in neutral	6. Slip
		7. Pulsating pedal
		8. Freezing

__6__ g. Pressure plate spring tension weak; excessively worn clutch disc; oil contamination; improperly adjusted clutch linkage

__2__ h. Oil contamination; clutch disc glazed from overheating; warped pressure plate or flywheel; weak pressure plate spring

11. Stop. Have your instructor evaluate your pretest and mark the area(s) below requiring additional study.

Refer to Information Sheet, Section(s)

I _____	VI _____
II _____	VII _____
III _____	VIII _____
IV _____	IX _____
V _____	X _____

You came here from Learning Step 2. If none of the above sections are checked, proceed to Learning Step 13. Otherwise, continue to Learning Step 3.

SECTION C--DRIVE TRAIN
UNIT I--CLUTCH ASSEMBLY

LAP ASSIGNMENT SHEET #1

NAME _____ SCORE _____

1. Match terms and definitions associated with the clutch assembly. Write the correct terms in the blanks before their definitions.

Free travel	Clutch disc
Pilot bearing	Clutch disc spin time
Flywheel	Release fork
Pressure plate	Release bearing

a. **Release fork** --Y-shaped lever inside clutch housing used to engage and disengage clutch

b. **Clutch disc spin time** --Time it takes for the clutch disc to stop spinning after clutch releases

c. **Flywheel** --Heavy metal disc which has a friction surface for the clutch plate and supports all of the clutch components

d. **Release bearing** --Bearing which provides a method of releasing spring pressure of the pressure plate

e. **Clutch disc** --Plate which provides friction between pressure plate and flywheel

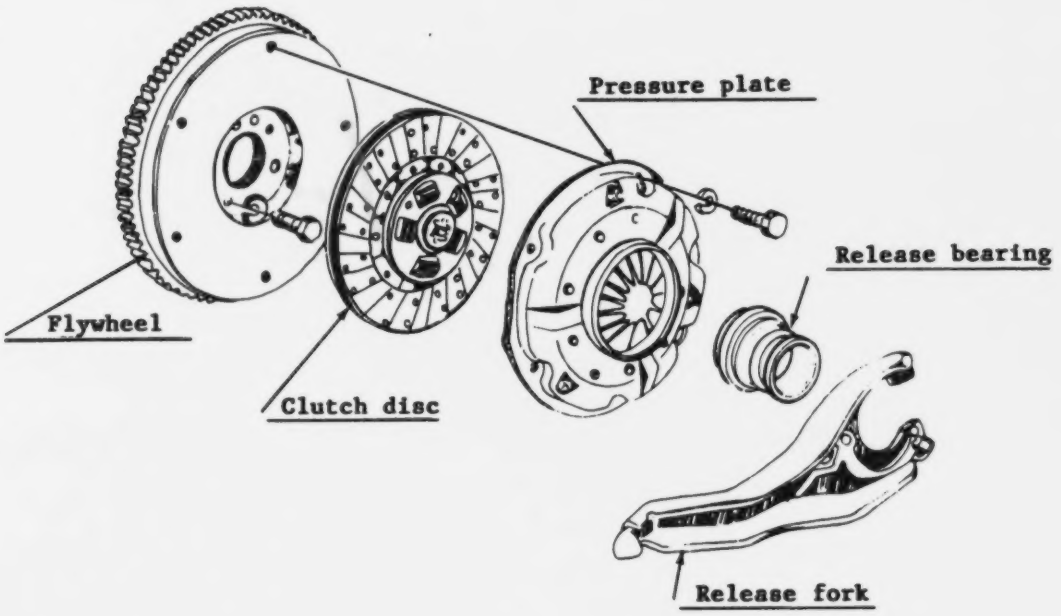
f. **Free travel** --Amount of clutch pedal movement before release bearing contacts pressure plate fingers

g. **Pilot bearing** --Bearing located in the flywheel flange of the crankshaft which allows for correct support and alignment of transmission input shaft

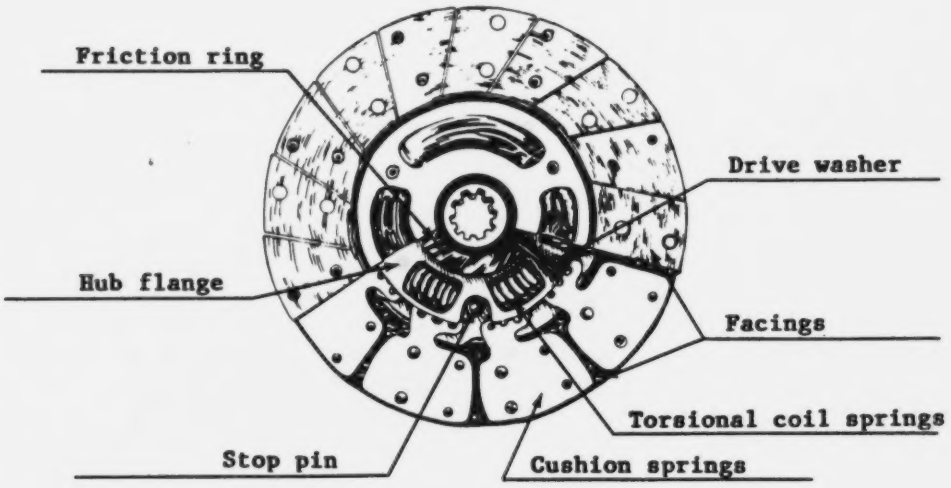
h. **Pressure plate** --Housing, spring, and plate assembly which provides pressure to clamp clutch disc between pressure plate and flywheel

LAP ASSIGNMENT SHEET #1

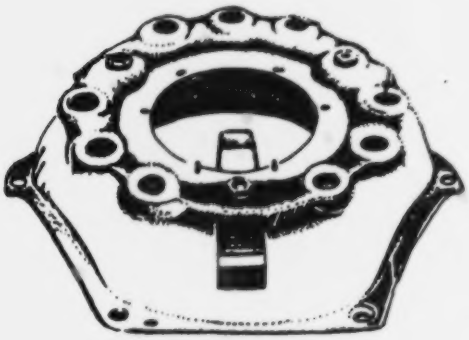
2. Label the components of the clutch assembly illustrated below. Write the correct names of the components in the blanks.



3. Label the parts of the clutch disc illustrated below. Write the correct names of the parts in the blanks.

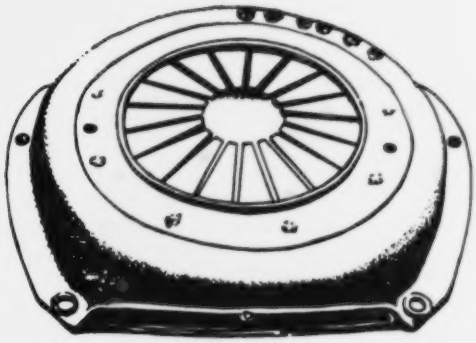


4. Label the types of pressure plates illustrated below. Write the correct names in the blanks.



a. Coil spring

c. Centrifugal



b. Diaphragm

5. Stop. Have your instructor evaluate your Assignment Sheet and mark the area(s) below requiring additional study.

Refer to Information Sheet, Section(s)

I _____ II _____ III _____ IV _____

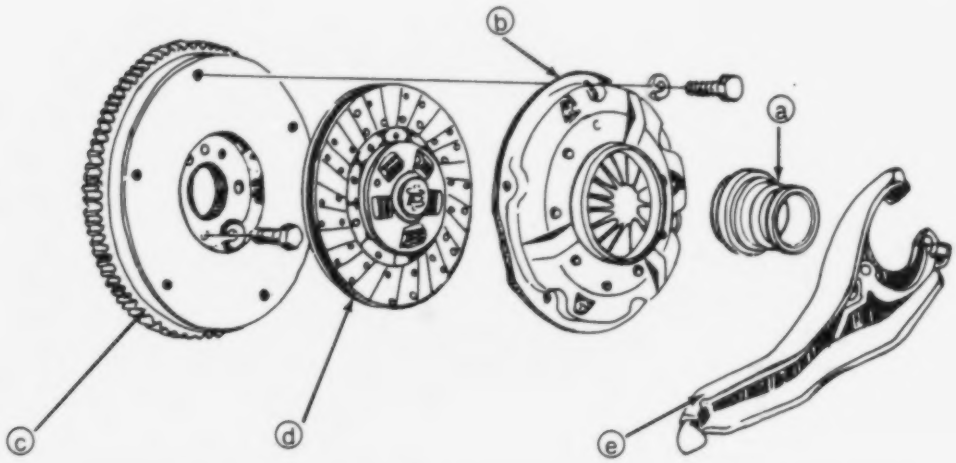
If none of the above sections are checked, proceed to Learning Step 7. Otherwise, continue to Learning Step 6.

SECTION C--DRIVE TRAIN
UNIT I--CLUTCH ASSEMBLY

LAP ASSIGNMENT SHEET #2

NAME _____ SCORE _____

1. Label the components of the clutch assembly illustrated below. Write the correct name of each component in the blanks below the drawing and then describe the function of each component.



a. Release bearing -- Bearing which provides a method of releasing spring pressure of the pressure plate

b. Pressure plate -- Housing, spring, and plate assembly which provides pressure to clamp clutch disc between pressure plate and flywheel

c. Flywheel -- Heavy metal disc which has a friction surface for the clutch plate and supports all of the clutch components

d. Clutch disc -- Plate which provides friction between pressure plate and flywheel

e. Release fork -- Y-shaped lever inside clutch housing used to engage and disengage clutch

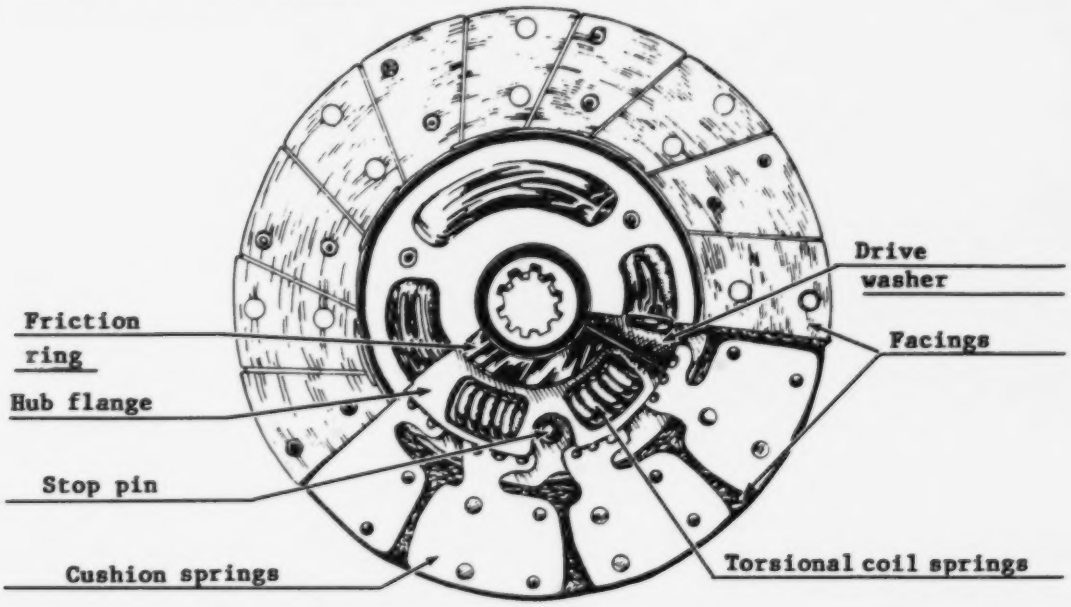
2. State the definition for each of the terms below.

   a. Free travel-- Amount of clutch pedal movement before release bearing contacts pressure plate fingers

   b. Clutch disc spin time-- Time it takes for clutch disc to stop spinning after clutch release

   c. Pilot bearing-- Bearing located in the flywheel flange of the crankshaft which allows for correct support and alignment of transmission input shaft

3. Label the parts of the clutch disc illustrated below. Write the correct names of the parts in the blanks.



4. List types of pressure plates, and then describe how each one provides pressure.

   a. Diaphragm -- Thin, dished steel plate

   b. Coil spring -- Group of coil springs

   c. Centrifugal -- Combination of coil springs and centrifugal weights

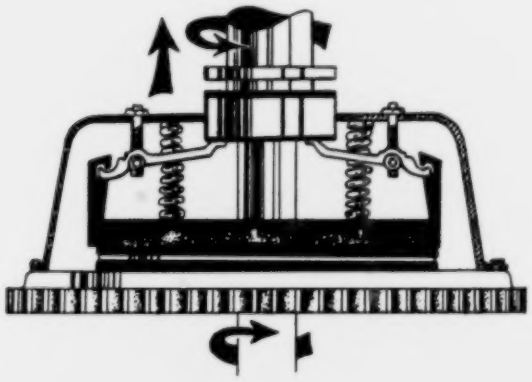
5. Stop. Have your instructor evaluate your Assignment Sheet. If your instructor is satisfied with your progress, continue to Learning Step 7. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, continue to Learning Step 7.

SECTION C--DRIVE TRAIN
UNIT I--CLUTCH ASSEMBLY

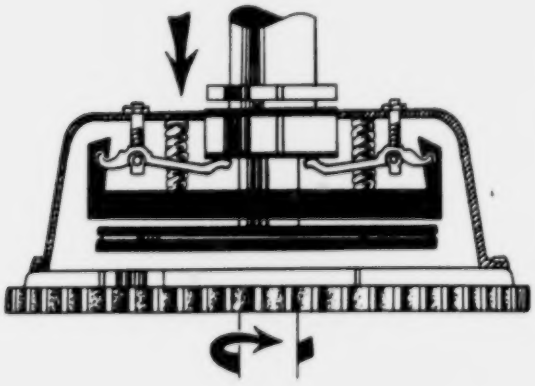
LAP ASSIGNMENT SHEET #3

NAME _____ SCORE _____

1. Label the clutch operation position of each of the following illustrations, and then describe the operation of each position.



a. Engaged -- Spring pressure clamps clutch disc between pressure plate and flywheel face



b. Disengaged -- Release bearing and linkage are used to release spring pressure

LAP ASSIGNMENT SHEET #3

2. List methods used to actuate clutch release (transfer motion from the clutch pedal to the release fork).

   a. Links, levers, and rods

   b. Hydraulic system using a master cylinder and slave cylinder

3. Answer the following questions about cushioning and dampening devices.

   a. What is the function of the cushioning and dampening devices?

      To allow smooth clutch engagement

   b. What type of mechanism is used in these devices?

      Spring

   c. Which device has a thin spring between clutch disc facings?

      Cushioning

   d. Which device has a series of heavy coil springs placed in the clutch disc hub?

      Dampening

4. Stop. Have your instructor evaluate your Assignment Sheet and mark the area(s) below requiring additional study.

   Refer to Information Sheet, Section(s)

   V _____ VI _____ VII _____

   If none of the above sections are checked, proceed to Learning Step 10. Otherwise, continue to Learning Step 9.

SECTION C--DRIVE TRAIN
UNIT I--CLUTCH ASSEMBLY

LAP ASSIGNMENT SHEET #4

NAME _____ SCORE _____

1. Fill in the blanks to complete statements concerning clutch operation.

   a. When the clutch is engaged, spring pressure clamps the clutch disc between the pressure plate and the flywheel face.

   b. When the clutch is disengaged, release bearing and linkage are used to release spring pressure.

2. List methods used to actuate clutch release.

   a. Links, levers, and rods connected to transfer motion from clutch pedal to release fork

   b. Hydraulic system using a master cylinder and slave cylinder to transfer motion from clutch pedal to release fork

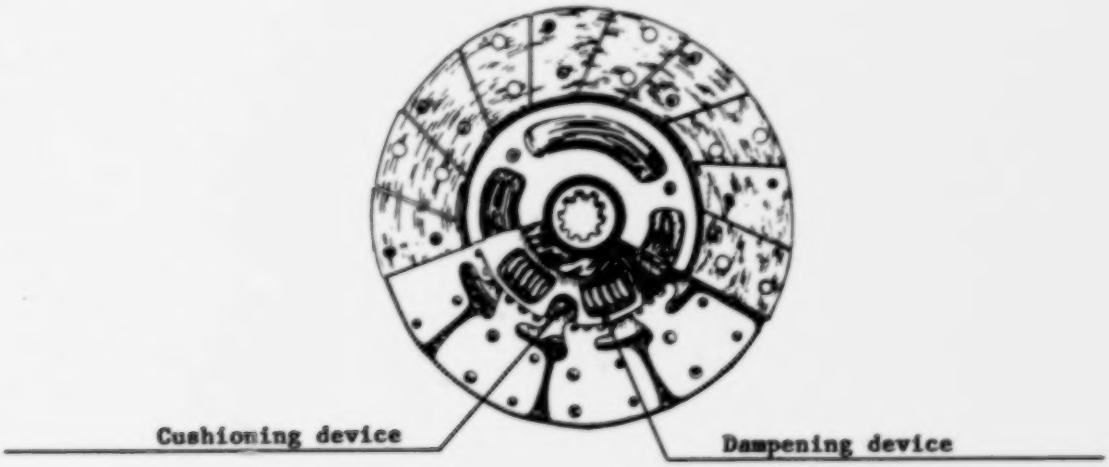
3. Fill in the blanks to complete the following definitions of mechanisms that allow smooth clutch engagement.

   a. Dampening device--Series of heavy coil springs placed in the clutch disc hub to absorb shock.

   b. Cushioning device--Thin, waved cushion spring between clutch disc facings.

LAP ASSIGNMENT SHEET #4

4. Identify the cushioning device and the dampening device on the illustration below. Write the correct names in the blanks.



5. Stop. Have your instructor evaluate your Assignement Sheet. If your instructor is satisfied with your progress, continue to Learning Step 10. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, continue to Learning Step 10.

SECTION C--DRIVE TRAIN
UNIT I--CLUTCH ASSEMBLY

LAP ASSIGNMENT SHEET #5

NAME _____ SCORE _____

1. List conditions to look for during clutch inspection.

   a. Normal finger wear
   b. Excessive finger wear
   c. Slight chatter marks
   d. Excessive heat discoloration
   e. Excessive warpage
   f. Heat cracks
   g. Wear pattern from warped pressure plate or flywheel
   h. Worn clutch disc
   i. Loose or worn clutch disc hub
   j. Worn clutch shaft spline
   k. Work pilot bearing
   l. Weak pressure plate spring tension
   m. Release fork pivot and finger wear
   n. Notched or rough release bearing support

2. List symptoms that may occur when a clutch housing bore has excessive runout.

   a. Excessive transmission gear wear or noise
   b. Transmission jumping out of gear
   c. Drive line vibration
   d. Clutch pedal vibration
   e. Scrubby pedal feel
   f. Pilot bearing noise
   g. Excessive clutch spin time

LAP ASSIGNMENT SHEET #5

3. Match clutch malfunctions and their probable causes. Write the correct numbers in the blanks. (Some blanks will have more than one correct answer.)

5,9,1,18	a. Slip	1. Oil contamination
7,4	b. Noise bearing	2. Release bearing dragging on support
13,10	c. Drag	3. Clutch disc glazed from over-heating
1,3,6,15	d. Chatter	4. Pitted clutch shaft bearing when the clutch is engaged with transmission in neutral
11,8,17	e. Grab	5. Pressure plate spring tension weak
16	f. Freezing	6. Warped pressure plate or fly-wheel
12,2	g. Binding	7. Worn or dry pilot or release bearing when clutch is disengaged
14	h. Pedal pulsating	8. Glazed clutch surface from being overheated
		9. Excessively worn clutch disc
		10. Broken pivots in pressure plate
		11. Oil contamination on clutch assembly
		12. Worn or misaligned linkage
		13. Pressure plate not releasing due to improper linkage adjustment
		14. Uneven pressure plate finger height
		15. Weak pressure plate spring
		16. Water-contaminated clutch disc rusted to flywheel and pressure plate
		17. Broken motor mounts
		18. Improperly adjusted clutch linkage

4. Stop. Have your instructor evaluate your Assignment Sheet and mark the area(s) below requiring additional study.

   Refer to Information Sheet, Section(s)

   VIII _____ IX _____ X _____

   If none of the above sections are checked, proceed to Learning Step 13. Otherwise, continue to Learning Step 12.

SECTION C--DRIVE TRAIN
UNIT I--CLUTCH ASSEMBLY

LAP ASSIGNMENT SHEET #6

NAME _____ SCORE _____

1. Use the list below to answer questions concerning conditions to look for during clutch inspection. (Some answers will be used more than once.)

Wear pattern from warped pressure plate or flywheel	Heat cracks
Notched or rough release bearing support	Slight chatter marks
Excessive heat discoloration	Worn clutch shaft spline
Normal finger wear	Loose or worn clutch disc hub
Excessive finger wear	Release fork pivot and finger wear
Weak pressure plate spring tension	Worn clutch disc
	Excessive warpage
	Worn pilot bearing

a. What conditions can you <u>see</u>?

Normal finger wear; excessive finger wear; slight chatter marks; excessive heat discoloration; excessive warpage; heat cracks; wear pattern from warped pressure plate or flywheel; worn clutch disc; worn clutch disc hub; worn clutch shaft spline; worn pilot bearing; notched or rough release bearing support; release fork pivot and finger wear

b. What conditions can you <u>feel</u>?

Loose clutch disc hub; weak pressure plate spring tension; notched or rough release bearing support

2. Use the list below to answer questions concerning symptoms that may occur when a clutch housing bore has excessive runout. (Some answers will be used more than once.)

Drive line vibration	Excessive transmission gear wear or noise
Scrubby pedal feel	Excessive clutch spin time
Clutch pedal vibration	Pilot bearing noise
Transmission jumping out of gear	

a. What symptoms can you hear?

Excessive transmission gear wear or noise; pilot bearing noise; excessive clutch spin time

b. What symptoms can you feel?

Transmission jumping out of gear; drive line vibration; clutch pedal vibration; scrubby pedal feel; excessive clutch spin time

3. You are on the school bus maintenance crew. List probable causes for the following clutch malfunctions.

a. The bus driver says that the clutch grabs when she presses it.

Oil contamination on clutch assembly; broken motor mounts; glazed clutch surface from being overheated

b. You test the clutch and hear chatter.

Oil contamination; clutch disc glazed from overheating; warped pressure plate or flywheel; weak pressure plate spring

c. When the driver brings the bus to the barn and parks it, you hear bearing noise.

Worn or dry pilot or release bearing when clutch is disengaged; pitted clutch shaft bearing when the clutch is engaged with transmission in neutral

d. Old Number 42 has been in the yard for several months waiting for parts. The engine starts right up, but the clutch is frozen.

Water-contaminated clutch disc rusted to flywheel and pressure plate

e. After you get the clutch released on Old Number 42, the pedal pulsates.

Uneven pressure plate finger height

f. Bob MacKenzie brings his bus back to the barn because the clutch is slipping.

Pressure plate spring tension weak; excessively worn clutch disc; oil contamination; improperly adjusted clutch linkage

g. The new driver says the clutch "feels funny." You test it and notice that it's binding.

Worn or misaligned linkage; release bearing dragging on support

h. Your supervisor tells you to check the new bus--the clutch drags.

Pressure plate not releasing due to improper linkage adjustment; broken pivots in pressure plate

4. Stop. Have your instructor evaluate your Assignment Sheet. If your instructor is satisfied with your progress, continue to Learning Step 13. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, continue to Learning Step 13.

State Department of Vocational and Technical Education CIMC Stillwater, Oklahoma LEARNING ACTIVITY PACKETS

for AUTO MECHANICS II

LAP NO._____ CODE:_____

MAJOR INSTRUCTIONAL AREA SECTION C--DRIVE TRAIN

INSTRUCTIONAL UNIT UNIT II--STANDARD TRANSMISSION

LEARNING ACTIVITY PACKET NO. 16

PREREQUISITE LAP(S) 2, 8, 15

PURPOSE: This Learning Activity Packet (LAP) outlines the study activities and performance tasks for "Standard Transmission." Accomplishing these procedures will aid the student in attaining a working knowledge of this area of training and in achieving a Skilled or Moderately Skilled competency level in the performance of jobs associated with this specialty.

INTRODUCTION: The course of study in this LAP will help the student become able to describe the construction and operation of a standard transmission and electrically operated overdrive and to remove and correctly replace, disassemble, inspect, and reassemble a three-speed transmission.

TASKS INCLUDED IN THIS LAP:

1. Remove and replace a standard transmission.
2. Disassemble, inspect, and reassemble a three-speed transmission.

SECTION C--DRIVE TRAIN
UNIT II--STANDARD TRANSMISSION

LEARNING STEPS

Check the following blanks as you complete the required steps.

_____ 1.	Read	Unit and Specific Objectives, page AM II-43-C.
_____ 2.	Complete	Standard Transmission Pretest, LAP page 7.
_____ 3.	Study	The sections of the Information Sheet, pages AM II-45-C through AM II-49-C, indicated by your instructor on your pretest. Be sure to study the transparency masters when required.
_____ 4.	Refer	To Step 11 of your pretest. If additional study is required for any of the Information Sheet, Sections I through V, continue to Learning Step 5. Otherwise, proceed to Learning Step 7.
_____ 5.	Do	LAP Assignment Sheet #1, LAP page 13.
_____ 6.	Do	LAP Assignment Sheet #2, LAP page 17.
_____ 7.	Refer	To Step 11 of the pretest. If additional study is required for any of the Information Sheet, Sections VI through X, continue to Learning Step 8. Otherwise, proceed to Learning Step 10.
_____ 8.	Do	LAP Assignment Sheet #3, LAP page 21.
_____ 9.	Do	LAP Assignment Sheet #4, LAP page 27.

_____10. Check — The tasks below that you think you can perform without supervision.

Student Check		Instructor Initials/Date: Skilled	Moderately Skilled
_____a.	Remove and replace a standard transmission. (15)	_____	_____
_____b.	Disassemble, inspect, and reassemble a three-speed transmission. (21)	_____	_____

_____11. Discuss — Your competency in each task with your instructor. Your instructor will initial each task in which you demonstrate sufficient competency. If both tasks have been initialed by your instructor, proceed to Learning Step 24. Otherwise, continue to Learning Step 12.

_____12. Refer — To Learning Step 10a. If this task has been initialed by your instructor, proceed to Learning Step 18. Otherwise, continue to Learning Step 13.

_____13. Study — Job Sheet #1--Remove and Replace a Standard Transmission, page AM II-69-C.

_____14. Watch — Slide/tape presentation, "Remove and Replace a Standard Transmission" (C-II-1).

_____15. Do — Job Sheet #1--Remove and Replace a Standard Transmission.

_____16. Stop. — Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, proceed to Learning Step 18. Otherwise, repeat Learning Steps 13 through 15 and then continue to Learning Step 17.

_____17.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, continue to Learning Step 18. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, continue to Learning Step 18.
_____18.	Refer	To Learning Step 10b. If this task has been initialed by your instructor, proceed to Learning Step 24. Otherwise, continue to Learning Step 19.
_____19.	Study	Job Sheet #2--Disassemble, Inspect, and Reassemble a Three-Speed Transmission, page AM II-73-C.
_____20.	Watch	Slide/tape presentation, "Disassemble, Inspect, and Reassemble, a Three-Speed Transmission" (C-II-2).
_____21.	Do	Job Sheet #2--Disassemble, Inspect, and Reassemble a Three-Speed Transmission.
_____22.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, proceed to Learning Step 24. Otherwise, repeat Learning Steps 19 through 21 and then continue to Learning Step 23.
_____23.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, continue to Learning Step 24. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, continue to Learning Step 24.
_____24.	Review	Information Sheet (pages AM II-47-C through AM II-49-C) and LAP Assignment Sheets.

_____25.	Take	Standard Transmission Test (see your instructor). If your score is 85 percent or above, continue to the next assigned Learning Activity Packet. Otherwise, ask your instructor about additional study requirements and possible retesting.

SECTION C--DRIVE TRAIN
UNIT II--STANDARD TRANSMISSION

PRETEST

NAME _____ SCORE _____

DIRECTIONS: This pretest is to determine how much you already know about a standard transmission. Your performance on this pretest will not be used to determine your grade in this course. Instead, it will guide your instructor in designing this course to meet your needs. If you are unsure of the answer to a question, do not guess. Guessing may prevent you from receiving needed instruction.

1. State the purpose of a transmission.

   To provide a method of varying the gear ratio between the engine and rear wheels and to provide a reverse

2. Match terms and definitions associated with a standard transmission. Write the correct numbers in the blanks.

4 a.	Gear in the transmission used to change direction of rotation of the output shaft	1. Constant mesh
6 b.	Turning or twisting effort	2. Counter gear
2 c.	Gear that rotates backward	3. Synchromesh transmission
7 d.	Relationship between the number of turns made by a driving gear to complete one full turn of the driven gear	4. Idler gear
3 e.	Transmission using synchronizers that prevent grinding of gear teeth while shifting gears	5. Cluster gear
8 f.	Device in the transmission that brings two gears being shifted together to rotate at the same speed	6. Torque
1 g.	Gears that are always in mesh with each other	7. Gear ratio
5 h.	Group of gears made on a common casting; used in a standard transmission to connect the main drive gear to the first, second, and reverse idler gears	8. Synchronizer

3. Identify the parts of the transmission illustrated below. Write the correct letters in the blanks.

__a__ Input shaft (clutch shaft)

__b__ Input shaft bearing retainer

__c__ Input shaft gear (main drive gear)

__d__ Second and third gear synchronizer assembly

__h__ Reverse gear

__j__ Extension housing

__o__ Counter shaft

__n__ Transmission case

__i__ Output shaft (main shaft)

__f__ First speed gear

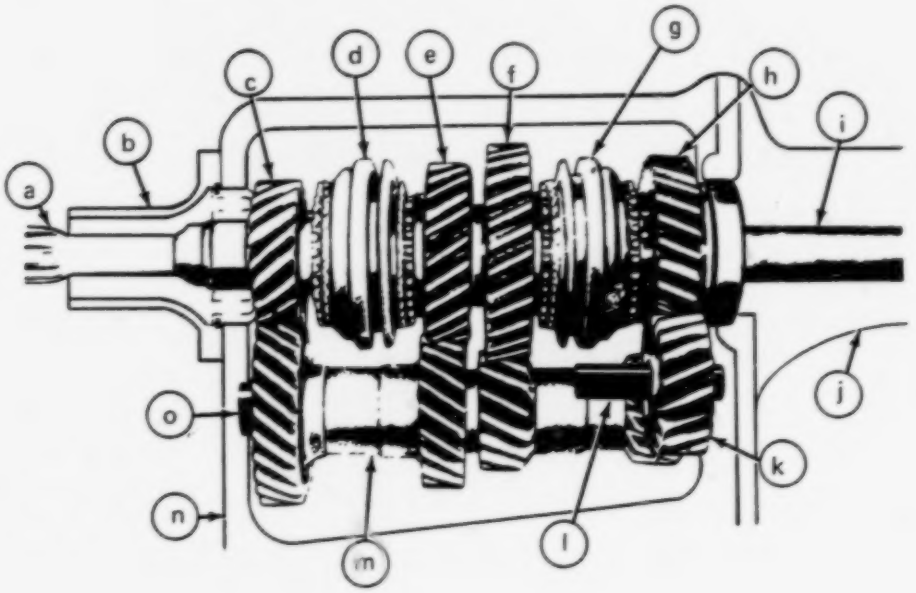
__m__ Counter or cluster gear

__l__ Reverse idler gear shaft

__g__ First and reverse synchronizer assembly

__e__ Second speed gear

__k__ Reverse idler gear



4. Identify the parts of the synchronizer illustrated below. Write the correct letters in the blanks.

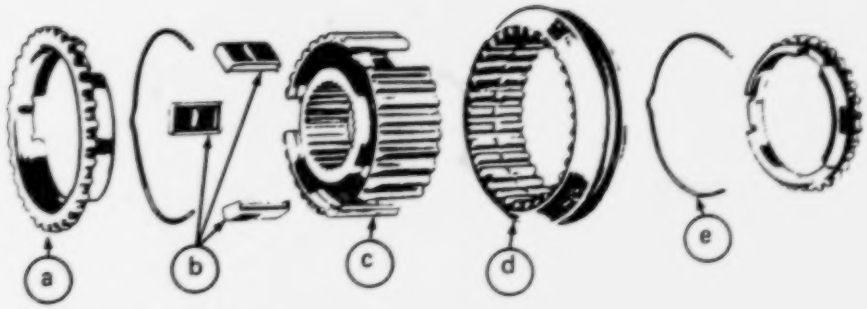
__d__ Sleeve

__b__ Inserts

__c__ Hub

__a__ Synchronizer ring

__e__ Insert springs



5. List the types of gear teeth commonly used in a standard transmission.

a. **Spur gear**

b. **Helical gear**

6. Discuss the operation of a three-speed synchromesh transmission.

a. Neutral-- **Input shaft drives the cluster gear which in turn drives the constant mesh second and reverse idler gears; no power is transmitted**

b. First gear-- **First and reverse synchronizer sleeve is moved to engage first gear; power is transmitted from the input shaft to cluster gear, to first gear, and to output shaft**

c. Second gear-- **Second and third gear synchronizer sleeve is moved to engage second gear; power is transmitted from the input shaft to cluster gear, to second gear, and on to output shaft**

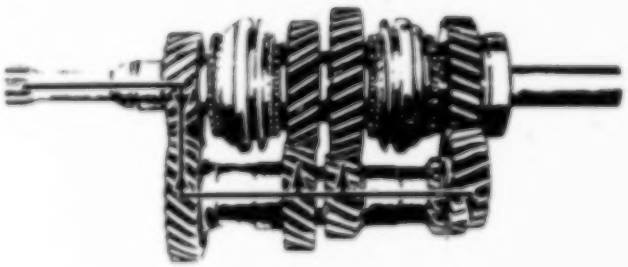
d. Third gear-- Second and third gear synchronizer sleeve is moved to engage third gear; power is transmitted from the input shaft to the output shaft

e. Reverse gear-- First and reverse synchronizer sleeve is moved to engage reverse idler gear; power is transmitted from the input shaft to the cluster gear; cluster gear drives the reverse idler gear; reverse idler gear drives the reverse gear and output shaft in a direction opposite engine rotation

7. Select the correct gear position for each of the drawings below. Circle the correct answers.

a. Neutral
First
Second
(Third)
Reverse

b. (Neutral)
First
Second
Third
Reverse



c. Neutral
(First)
Second
Third
Reverse

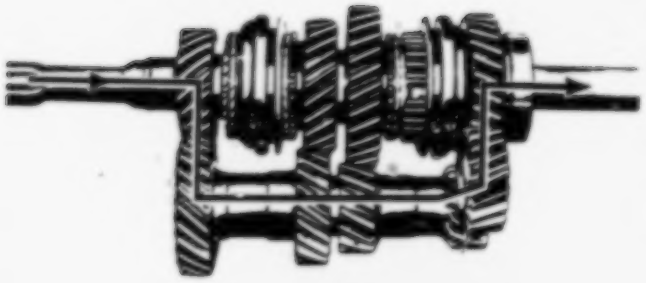
d. Neutral

First

Second

Third

(Reverse)



e. Neutral

First

(Second)

Third

Reverse

8. List the basic types of overdrives.

a. Manual fourth gear

b. Electrically operated planetary

9. Identify the components of the electrically operated overdrive illustrated below. Write the correct letters in the blanks.

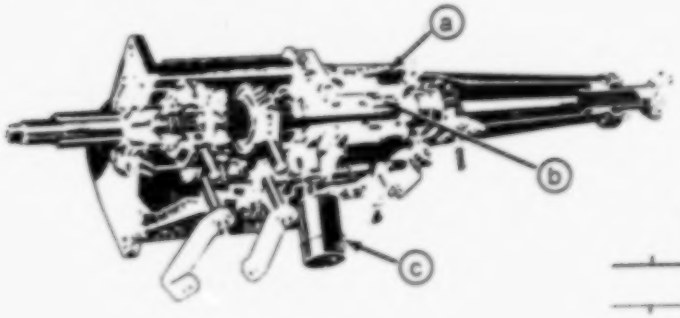
__c__ Shift solenoid

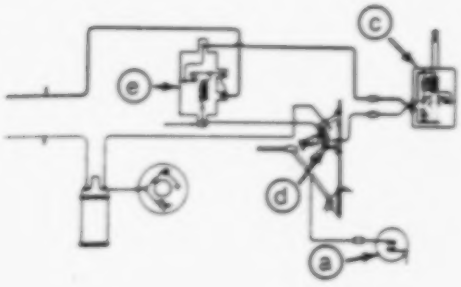
__a__ Governor

__d__ Kickdown switch

__e__ Relay

__b__ Planetary gearset





10. Describe the operation of an electrically operated overdrive.

Overdrive unit starts in direct drive. At approximately 35 mph (54 km/h) the governor closes the electrical circuit for shifting into overdrive. The driver momentarily lets up on the accelerator to relieve the pressure on the transmission and the shift is completed to overdrive speed. Downshift is accomplished by fully extending the accelerator pedal, causing the electrical circuit to shift the overdrive back to direct drive

11. Stop. Have your instructor evaluate your pretest and mark the area(s) below requiring additional study.

Refer to Information Sheet, Section(s)

_____I	_____VI
_____II	_____VII
_____III	_____VIII
_____IV	_____IX
_____V	_____X

You came here from Learning Step 2. If none of the above sections are checked, proceed to Learning Step 10. Otherwise, continue to Learning Step 3.

SECTION C--DRIVE TRAIN
UNIT II--STANDARD TRANSMISSION

LAP ASSIGNMENT SHEET #1

NAME _____ SCORE _____

1. Fill in the blanks to complete the statement below concerning the purpose of a transmission.

   The purpose of a transmission is to provide a method of varying the gear ratio between the engine and rear wheels and to provide a reverse.

2. Select from the list below terms associated with a standard transmission. Write the correct terms in the blanks before their definitions.

Idler gear	Constant mesh
Synchromesh transmission	Cluster gear
Counter gear	Torque
Synchronizer	Gear ratio

   a. Gear ratio --Relationship between the number of turns made by a driving gear to complete one full turn of the driven gear

   b. Torque --Turning or twisting effort

   c. Idler gear --Gear in the transmission used to change direction of rotation of the output shaft

   d. Counter gear --Gear that rotates backward

   e. Synchromesh transmission --Transmission using synchronizers that prevent grinding of gear teeth while shifting gears

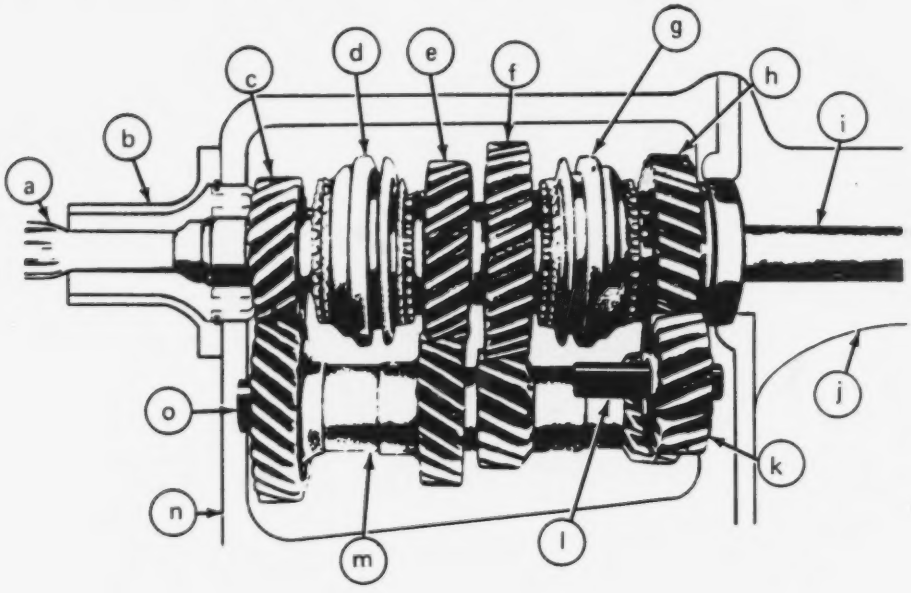
   f. Constant mesh --Gears that are always in mesh with each other

   g. Synchronizer --Device in the transmission that brings two gears being shifted together to rotate at the same speed

   h. Cluster gear --Group of gears made on a common casting; used in a standard transmission to connect the main drive gear to the first, second, and reverse idler gears

3. Identify the parts of the transmission illustrated below. Writ the correct names in the blanks.

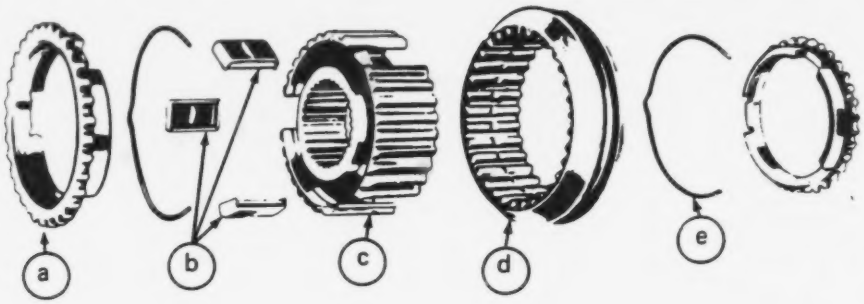
Input shaft (clutch shaft)
Reverse gear
Second speed gear
Output shaft (main shaft)
First speed gear
Transmission case
Counter shaft
Reverse idler gear shaft
First and reverse synchronizer assembly
Input shaft gear (main drive gear)
Second and third gear synchronizer assembly
Counter or cluster gear
Extension housing
Input shaft bearing retainer
Reverse idler gear



a. Input shaft (clutch shaft)
b. Input shaft bearing retainer
c. Input shaft gear (main drive gear)
d. Second & third synchronizer assembly
e. Second speed gear
f. First speed gear
g. First & reverse synchronizer assembly
h. Reverse gear
i. Output shaft (main shaft)
j. Extension housing
k. Reverse idler gear
l. Reverse idler gear shaft
m. Counter or cluster gear
n. Transmission case
Counter shaft

4. Identify the parts of the synchronizer illustrated below. Write the correct names in the blanks.

Synchronizer ring
Insert spring
Inserts
Sleeve
Hub



a. **Synchronizer ring**

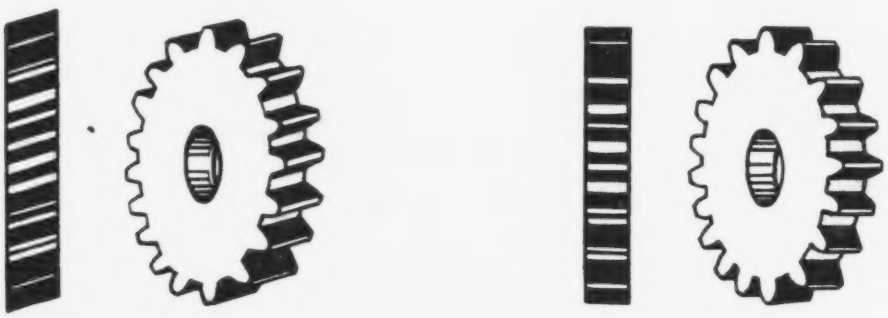
b. **Inserts**

c. **Hub**

d. **Sleeve**

e. **Insert spring**

5. Label types of gear teeth used in a standard transmission. Write the correct names in the blanks.



a. **Helical gear** b. **Spur gear**

6. Stop. Have your instructor evaluate your assignment sheet and mark the area(s) below requiring additional study.

   Refer to Information Sheet, Section(s)

   _____I _____II _____III _____IV _____V

   If none of the above sections are checked, proceed to Learning Step 7. Otherwise, continue to Learning Step 6.

SECTIONS C--DRIVE TRAIN
UNIT II--STANDARD TRANSMISSION

LAP ASSIGNMENT SHEET #2

NAME _____ SCORE _____

1. State the purpose of a transmission.

To provide a method of varying the gear ratio between the engine and rear wheels and to provide a reverse

2. Fill in the blanks to complete the following definitions.

a. Torque--**Turning** or **twisting** effort

b. Constant mesh--Gears that are always **in** **mesh** with each other

c. Synchronizer--Device in the transmission that brings **two** **gears** being shifted together to rotate at the **same** **speed**

d. Synchromesh transmission--Transmission using **synchronizers** that prevent **grinding** of gear **teeth** while shifting gears

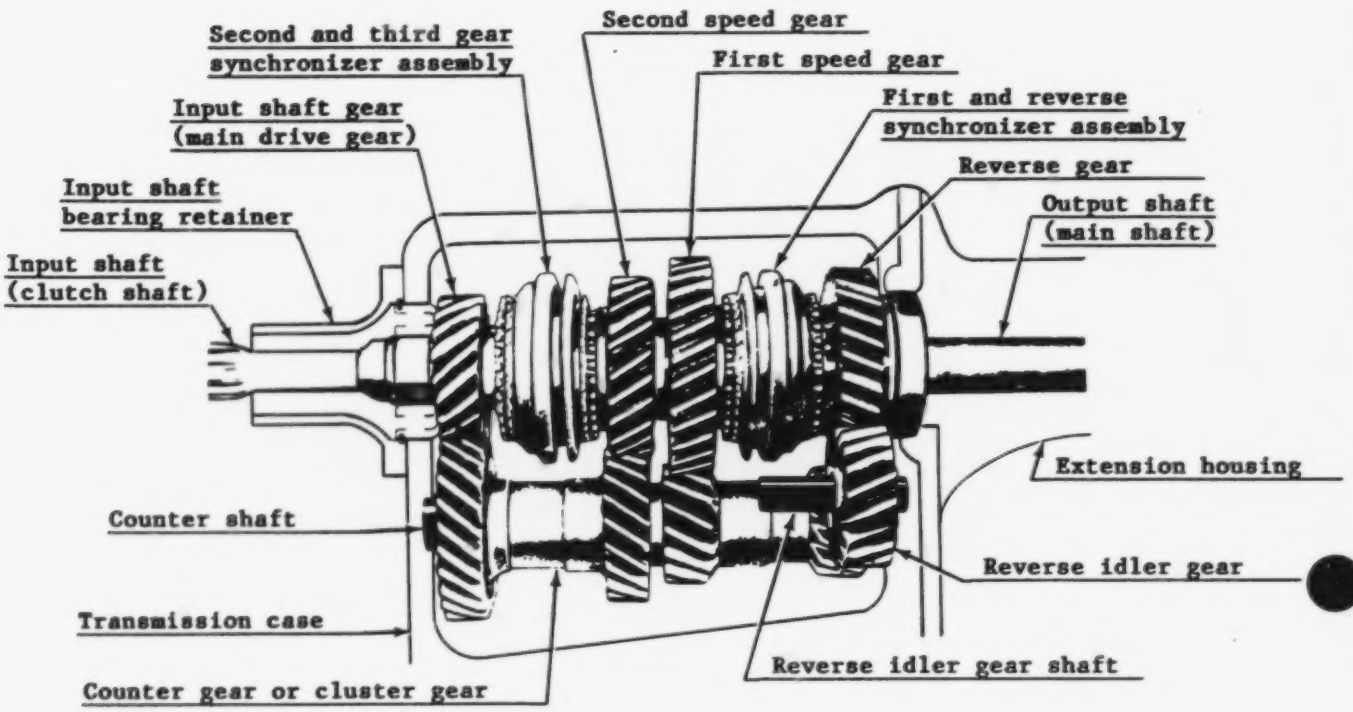
e. Gear ratio--Relationship between the **number** **of** **turns** made by a **driving** gear to complete one **full** **turn** of the **driven** gear

f. Idler gear--Gear in the transmission used to change **direction** **of** **rotation** of the **output** shaft

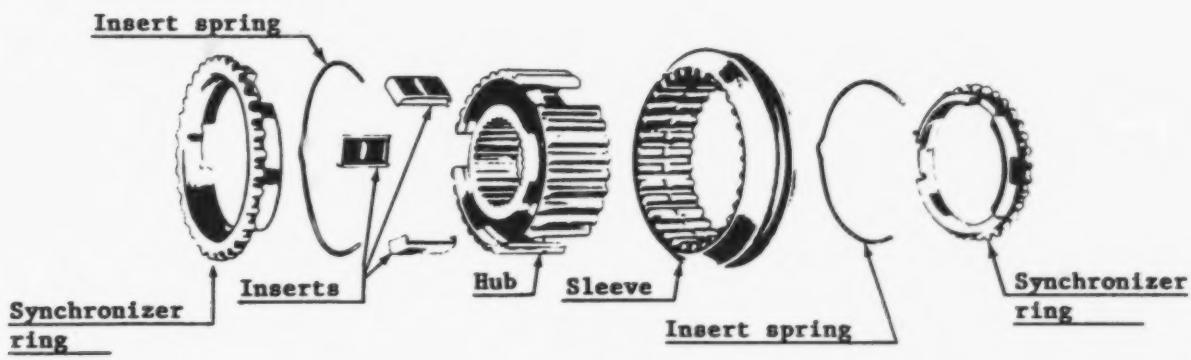
g. Cluster gear--Group of gears made on a **common** **casting**; used in a standard transmission to connect the **main** **drive** gear to the first, second, and reverse idler gears

h. Counter gear--Gear that rotates **backward**

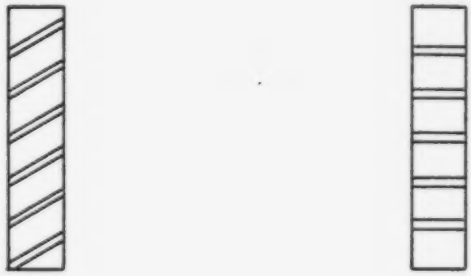
3. Label the parts of the transmission illustrated below. Write the correct names in the blanks.



4. Label the parts of the synchronizer illustrated below. Write the correct names in the blanks.



5. Draw the teeth in the boxes below to illustrate side views of spur and helical gear teeth.



6. Stop. Have your instructor evaluate your assignment sheet. If your instructor is satisfied with your progress, continue to Learning Step 7. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, continue to Learning Step 7.

SECTION C--DRIVE TRAIN
UNIT II--STANDARD TRANSMISSION

LAP ASSIGNMENT SHEET #3

NAME _____ SCORE _____

1. Fill in the blanks to complete statements describing three-speed synchromesh transmission operation.

   a. Neutral--Input shaft drives the cluster gear which in turn drives the constant mesh second and reverse idler gear. No power is transmitted.

   b. First gear--First and reverse synchronizer sleeve is moved to engage first gear; power is transmitted from the input shaft to cluster gear, to first gear, and on to output shaft.

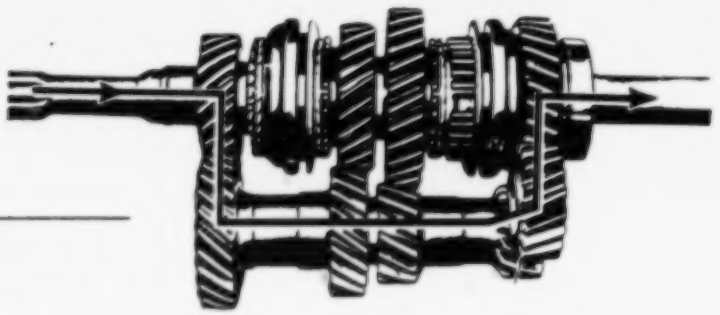
   c. Second gear--Second and third synchronizer sleeve is moved to engage second gear; power is transmitted from the input shaft to cluster gear, to second gear, and on to ouput shaft.

   d. Third gear--Second and third gear synchronizer sleeve is moved to engage third gear; power is transmitted from the input shaft to the output shaft.

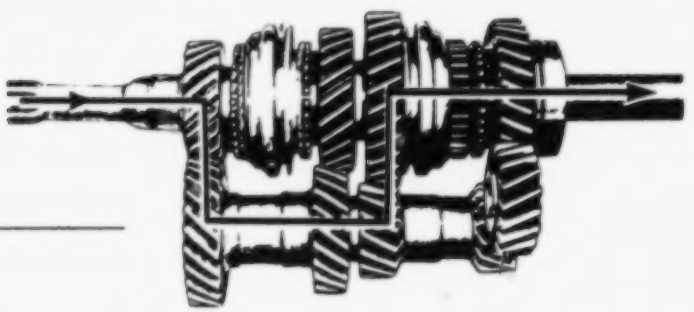
   e. Reverse gear--First and reverse synchronizer sleeve is moved to engage reverse idler gear; power is transmitted from the input shaft to the cluster gear; cluster gear drives the reverse idler gear; reverse idler gear drives the reverse gear and output shaft in a direction opposite engine rotation.

LAP ASSIGNMENT SHEET #3

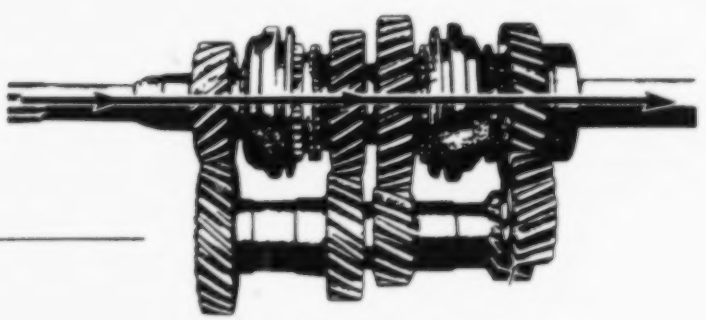
2. Label the correct gear position for each of the transmissions in the following illustrations.



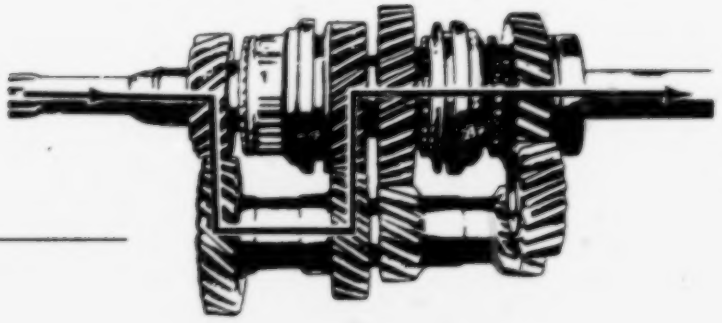
a. Reverse



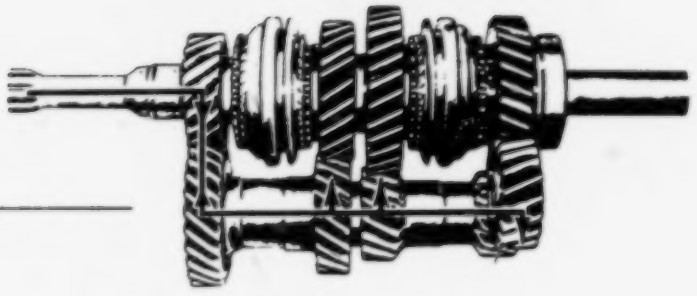
b. First



c. Third



d. Second



e. Neutral

3. List the basic types of overdrives.

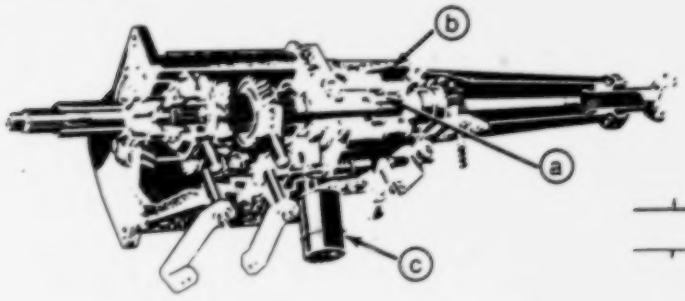
a. Manual fourth gear

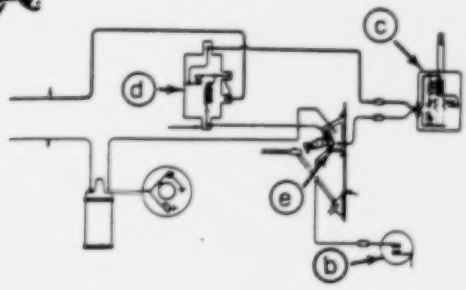
b. Electronically operated planetary

LAP ASSIGNMENT SHEET #3

4. Identify the components of the electrically operated overdrive illustrated below. Write the correct names in the blanks.

Relay
Governor
Kickdown switch
Planetary gearset
Shift solenoid





a. Planetary gearset

b. Governor

c. Shift solenoid

d. Relay

e. Kickdown switch

5. Fill in the blanks to complete statements describing the operation of the electrically operated overdrive.

a. Overdrive unit starts in direct drive.

b. At approximately 35 mph (54 km/h) the governor closes the electrical circuit for shifting into overdrive.

c. The driver momentarily lets up on the accelerator to relieve the pressure on the transmission and the shift is completed to overdrive speed.

d. Downshift is accomplished by fully extending the pedal, causing the electrical circuit to shift the overdrive back to direct drive.

6. Stop. Have your instructor evaluate your Assignment Sheet and mark the area(s) below requiring additional study.

   Refer to Information Sheet, Section(s)

   _____VI _____VII _____VIII _____IX _____X

   If none of the above sections are checked, proceed to Learning Step 10. Otherwise, continue to Learning Step 9.

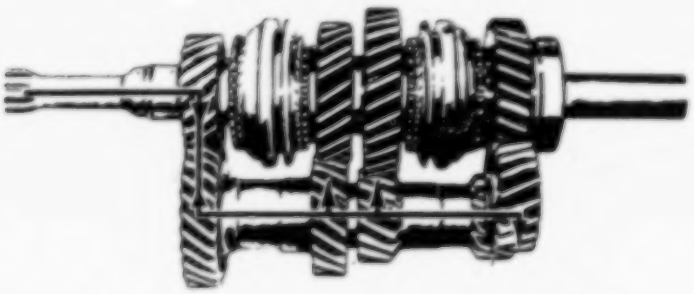
SECTION C--DRIVE TRAIN
UNIT II--STANDARD TRANSMISSION

LAP ASSIGNMENT SHEET #4

NAME _____ SCORE _____

1. Fill in the missing words to complete the sequence of actions for each position in a three-speed synchromesh transmission.

   a. Neutral



   Input shaft drives the cluster gear, which in turn drives the constant mesh second gear and reverse idler gear. Where is the power transmitted? No power is transmitted

   b. First gear

   First and reverse gear synchronizer sleeve is moved to engage first gear. Power is transmitted from the input shaft to cluster gear, to first gear, and on to output shaft.

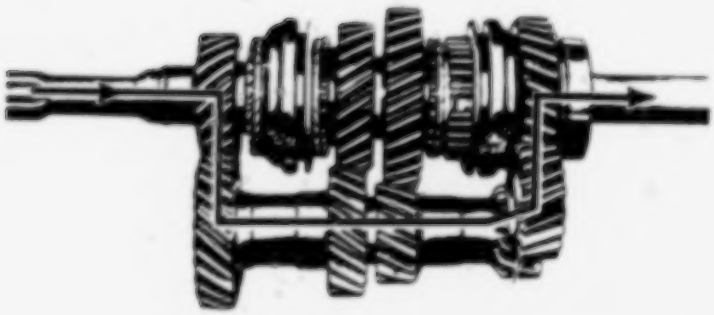
c. Second gear

Second and third gear synchronizer sleeve is moved to engage second gear. Power is transmitted from the input shaft to cluster gear, to second gear, and on to output shaft.

d. Third gear

Second and third gear synchronizer sleeve is moved to engage third gear. Power is transmitted from the input shaft to the output shaft.

e. Reverse



First and reverse synchronizer sleeve is moved to engage reverse idler gear. Power is transmitted from the input shaft to the cluster gear, which drives the reverse idler gear. Reverse idler gear drives the reverse gear and output shaft in a direction that is opposite engine rotation.

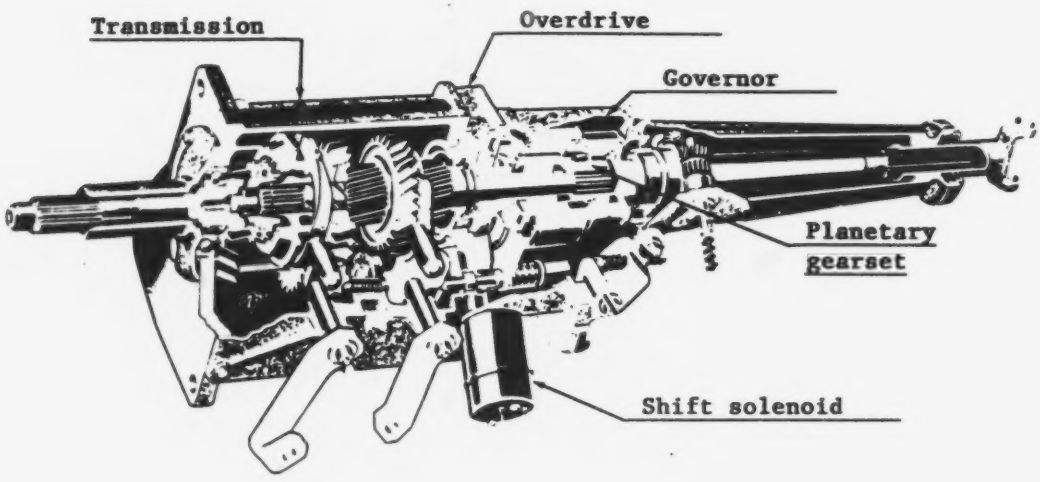
2. Name the basic types of overdrives.

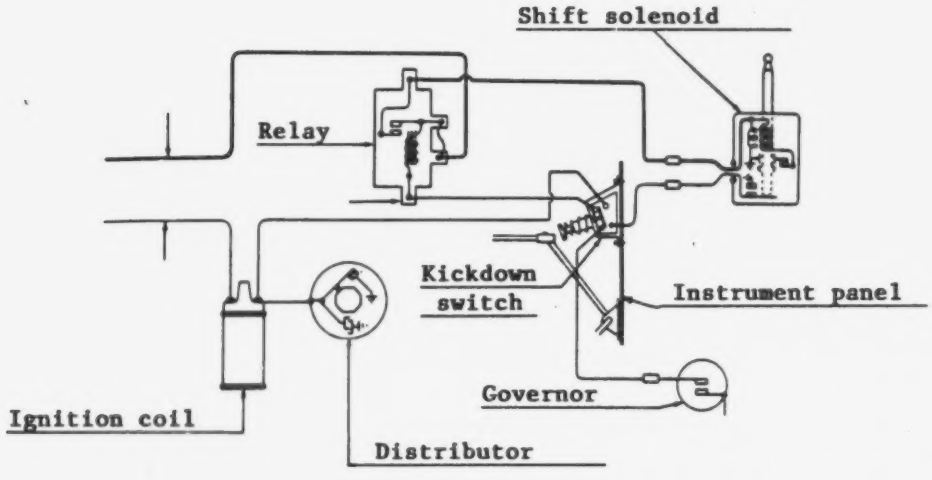
a. Manual fourth gear

b. Electrically operated planetary

LAP ASSIGNMENT SHEET #4

3. Label major parts of the electrically operated overdrive illustrated below. Write the correct names in the blanks.





4. Complete the following statements to describe the operation of an electrically operated overdrive.

   a. Overdrive unit starts in **direct drive**

   b. At approximately 35 mph, the governor **closes the electrical circuit for shifting into overdrive**

   c. The driver momentarily lets up on the accelerator to **releive the pressure on the transmission and the shift is completed to overdrive speed**

   d. Downshift is accomplished by **fully extending the accelerator pedal, causing the electrical circuit to shift the overdrive back to direct drive**

5. Stop. Have your instructor evaluate your assignment sheet. If your instructor is satisfied with your progress, continue to Learning Step 10. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, continue to Learning Step 10.

State Department of Vocational and Technical Education CIMC Stillwater, Oklahoma LEARNING ACTIVITY PACKETS

for AUTO MECHANICS II

LAP NO._____ CODE:_____

MAJOR INSTRUCTIONAL AREA

SECTION C--DRIVE TRAIN

INSTRUCTIONAL UNIT

UNIT III--DRIVE LINES

LEARNING ACTIVITY PACKET NO. 17

PREREQUISITE LAP(S)

NONE

PURPOSE: This Learning Activity Packet (LAP) outlines the study activities and performance tasks for "Drive Lines." Accomplishing these procedures will aid the student in attaining a working knowledge of this area of training and in achieving a Skilled or Moderately Skilled competency level in the performance of jobs associated with this specialty.

INTRODUCTION: The course of study in this LAP will help the student become able to describe types and components of drive lines, and to remove, repair, balance, and align angles of the propeller shaft.

TASKS INCLUDED IN THIS LAP:

1. Remove and replace a propeller shaft.
2. Remove and replace a cross and roller U-joint.
3. Remove and replace a ball and trunnion U-joint.
4. Balance a propeller shaft.
5. Check and adjust U-joint angles.

SECTION C--DRIVE TRAIN
UNIT III-DRIVE LINES

LEARNING STEPS

Check the following blanks as you complete the required steps.

_____ 1. Read — Unit and Specific Objectives, page AM II 97-C.

_____ 2. Complete — Drive Train Pretest, LAP page 9.

_____ 3. Study — The sections of the Information Sheet, pages AM II 101-C through 104-C, indicated by your instructor on your pretest.

_____ 4. Refer — To Step 12 of the pretest. If additional study is required, continue to Learning Step 5. Otherwise, proceed to Learning Step 7.

_____ 5. Do — LAP Assignment Sheet #1, LAP page 17.

_____ 6. Do — LAP Assignment Sheet #2, LAP page 23.

_____ 7. Check — The tasks below that you think you can perform without supervision.

Student Check		Instructor Initials/Date: Skilled	Moderately Skilled
_____a.	Remove and replace a propeller shaft. (12)	_____	_____
_____b.	Remove and replace a cross and roller U-joint. (18)	_____	_____
_____c.	Remove and replace a ball and trunnion U-joint. (24)	_____	_____
_____d.	Balance a propeller shaft. (30)	_____	_____
_____e.	Check and adjust U-joint angles. (36)	_____	_____

_____ 8.	Discuss	Your competency in each task with your instructor. Your instructor will initial each task in which you demonstrate sufficient competency. If all tasks have been initialed by your instructor, proceed to Learning Step 39. Otherwise, continue to Learning Step 9.
_____ 9.	Refer	To Learning Step 7a. If this task has been initialed by your instructor, proceed to Learning Step 15. Otherwise, continue to Learning Step 10.
_____10.	Study	Job Sheet #1--Remove and Replace a Propeller Shaft, page AM II 125-C.
_____11.	Watch	Slide/tape presentation, "Remove and Replace a Propeller Shaft" (C-III-1).
_____12.	Do	Job Sheet #1--Remove and Replace a Propeller Shaft.
_____13.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 7a and proceed to Learning Step 15. Otherwise, repeat Learning Steps 10 through 12 and then continue to Learning Step 14.
_____14.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 7a and continue to Learning Step 15. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction have your instructor initial Learning Step 7a and then continue to Learning Step 15.
_____15.	Refer	To Learning Step 7b. If this task has been initialed by your instructor, proceed to Learning Step 21. Otherwise, continue to Learning Step 16.

_____16.	Study	Job Sheet #2--Remove and Replace a Cross and Roller U-Joint, page AM II 127-C.
_____17.	Watch	Slide/tape presentation, "Remove and Replace a Cross and Roller U-Joint (C-III-2).
_____18.	Do	Job Sheet #2--Remove and Replace a Cross and Roller U-Joint.
_____19.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 7b and proceed to Learning Step 21. Otherwise, repeat Learning Steps 16 through 18 and then continue to Learning Step 20.
_____20.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 7b and continue to Learning Step 21. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction have your instructor initial Learning Step 7b and then continue to Learning Step 21.
_____21.	Refer	To Learning Step 7c. If this task has been initialed by your instructor, proceed to Learning Step 27. Otherwise, continue to Learning Step 22.
_____22.	Study	Job Sheet #3--Remove and Replace a Ball and Trunnion U-Joint, page AM II-135-C.
_____23.	Watch	Slide/tape presentation, "Remove and Replace a Ball and Trunnion U-Joint" (C-III-3).

_____24.	Do	Job Sheet #3--Remove and Replace a Ball and Trunnion U-Joint.
_____25.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 7c and proceed to Learning Step 27. Otherwise, repeat Learning Steps 22 through 24 and then continue to Learning Step 26.
_____26.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 7c and continue to Learning Step 27. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 7c and then continue to Learning Step 27.
_____27.	Refer	To Learning Step 7d. If this task has been initialed by your instructor, proceed to Learning Step 33. Otherwise, continue to Learning Step 28.
_____28.	Study	Job Sheet #4--Balance a Propeller Shaft, page AM II-139-C.
_____29.	Watch	Slide/tape presentation, "Balance a Propeller Shaft" (C-III-4).
_____30.	Do	Job Sheet #4--Balance a Propeller Shaft.
_____31.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 7d and proceed to Learning Step 33. Otherwise, repeat Learning Steps 28 through 30 and then continue to Learning Step 32.

_____32.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 7d and continue to Learning Step 33. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 7d and then continue to Learning Step 33.
_____33.	Refer	To Learning Step 7e. If this task has been initialed by your instructor, proceed to Learning Step 39. Otherwise, continue to Learning Step 34.
_____34.	Study	Job Sheet #5--Check and Adjust U-Joint Angles, page AM II-143-C.
_____35.	Watch	Slide/tape presentation, "Check and Adjust U-Joint Angles" (C-III-5).
_____36.	Do	Job Sheet #5--Check and Adjust U-Joint Angles.
_____37.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 7e and proceed to Learning Step 39. Otherwise, repeat Learning Steps 34 through 36 and then continue to Learning Step 38.
_____38.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 7e and continue to Learning Step 39. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 7e and then continue to Learning Step 39.

_____39.	Review	Information Sheet (pages AM II-101-C through 104-C) and LAP Assignment Sheets.
_____40.	Take	Drive Line Test (see your instructor). If your score is 85 percent or above, continue to the next Learning Activity Packet. Otherwise, ask your instructor about additional study requirements and possible retesting.

SECTION C--DRIVE TRAIN
UNIT III--DRIVE LINES

PRETEST

NAME _____ SCORE _____

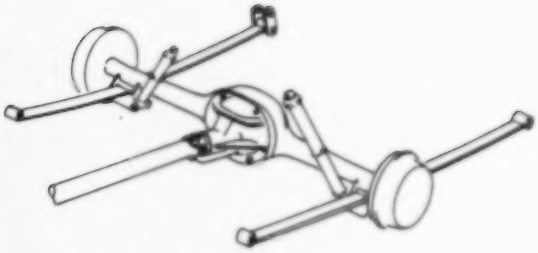
DIRECTIONS: This pretest is to determine how much you already know about drive lines. Your performance on this pretest will not be used to determine your grade in this course. Instead, it will guide your instructor in designing this course to meet your needs. If you are unsure of the answer to a question, do not guess. Guessing may prevent you from receiving needed instruction.

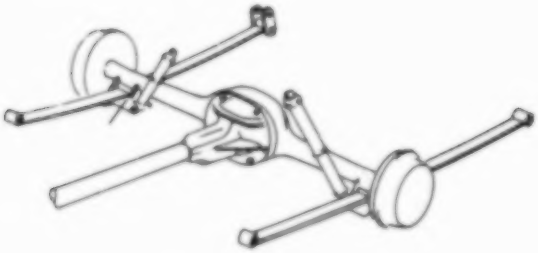
1. Match terms and definitions associated with drive lines. Write the correct numbers in the blanks.

1 a.	Variable-length connection at one end of a propeller shaft that allows the shaft to vary in length as the vehicle body moves up and down in relation to the rear axle	1. Slip joint 2. Propeller shaft 3. U-joint (universal joint) 4. U-joint timing 5. Cardan joint 6. Drive line 7. Whirl 8. Constant velocity
6 b.	Driving connection made up of one or more propeller shafts between transmission and differential	
4 c.	Procedure of aligning the yokes of a two or more piece propeller shaft to help control whirl and vibration in the propeller shaft	
3 d.	Coupling that allows power to be transferred through an angle	
2 e.	Shaft that connects the transmission to the rear axle to propel the vehicle	
7 f.	Propeller shaft runout or unbalanced condition causing the shaft to act similar to the looping action of a rope held at both ends and swung in an arc	
5 g.	Cross and roller U-joint	
8 h.	Two closely coupled cross and roller U-joints arranged so that their acceleration-deceleration effects cancel each other, resulting in output propeller shaft speed identical to input speed	

2. Identify the types of drive lines illustrated below. Write the correct names in the blanks.

Hotchkiss drive (open propeller shaft)
Torque-tube drive (closed propeller shaft)



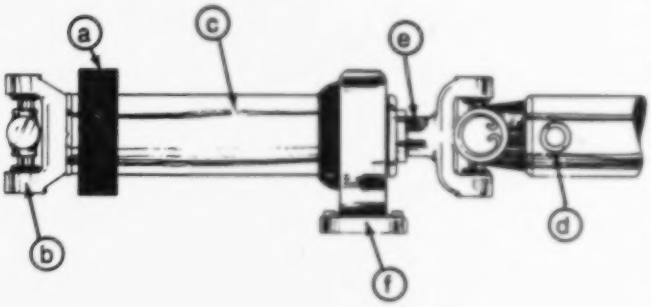


a. Hotchkiss drive (open propeller shaft)

b. Torque-tube drive (closed propeller shaft)

3. Identify the components of the propeller shaft illustrated below. Write the correct names in the blanks.

Slip joint
Balance weight
Center bearing support (carrier bearing)
Torsional damper
Shaft
U-joint



a. Torsional damper

b. U-joint

c. Shaft

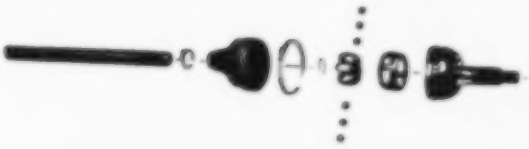
d. Balance weight

e. Slip joint

f. Center bearing support (carrier bearing)

4. Identify the types of U-joints illustrated below. Write the correct names in the blanks.

Rzeppa
Ball and trunnion
Cross and roller
Constant velocity



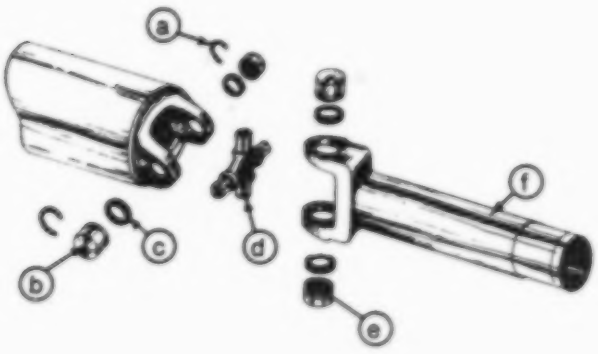
a. Constant velocity

b. Rzeppa

c. Cross and roller

d. Ball and trunnion

5. Identify the parts of the cross and roller U-joint illustrated below. Write the correct letters in the blanks.



d Cross

b Roller

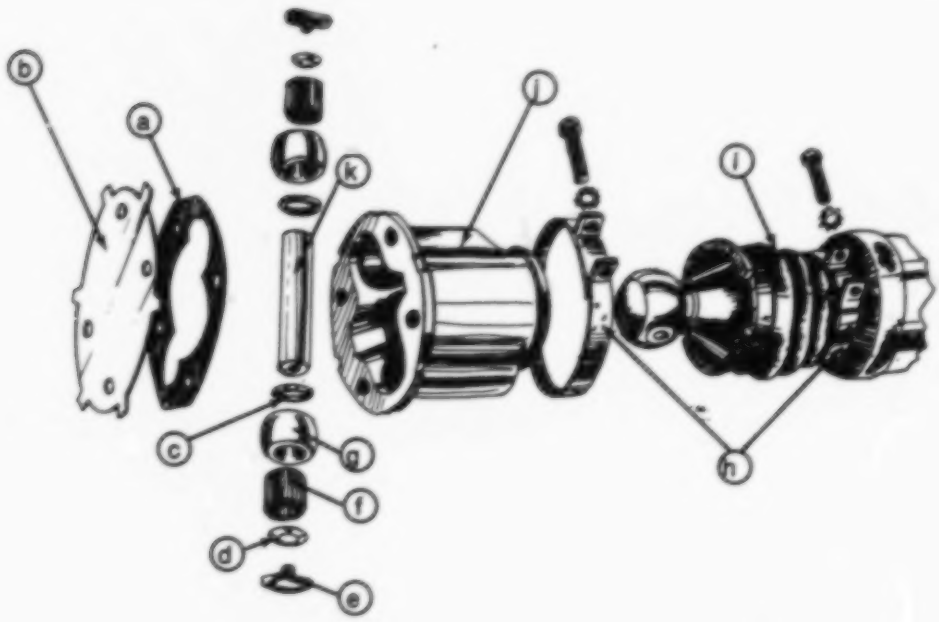
c Seal

f Yoke

a Snap ring

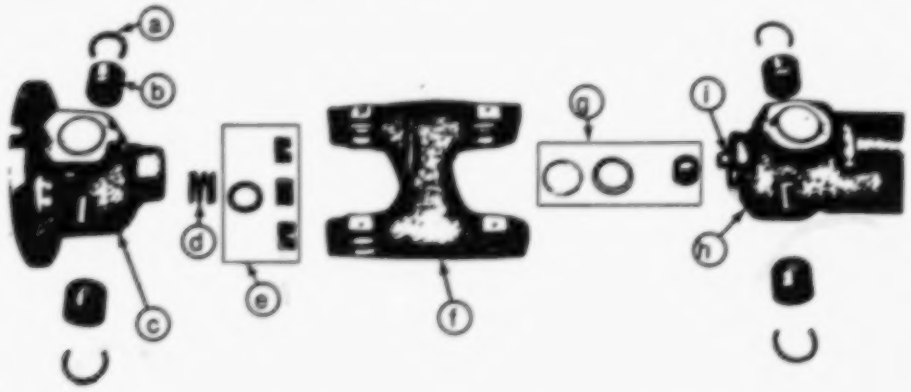
e Needle bearings

6. Identify the parts of the ball and trunnion U-joint illustrated below. Write the correct letters in the blanks.



c Thrust washer	d Button spring	h Clamps
f Needle bearings	b Grease cover	i Boot
k Trunnion pin	j U-joint housing	g Ball
a Gasket	e Centering button	

7. Identify the parts of the constant velocity U-joint illustrated below. Write the correct letters in the blanks.



c Ball support yoke	a Snap ring
b Roller and seal	g Centering ball assembly
h Ball tube yoke	e Ball seat assembly
i Ball stud	f Link yoke
d Ball spring	

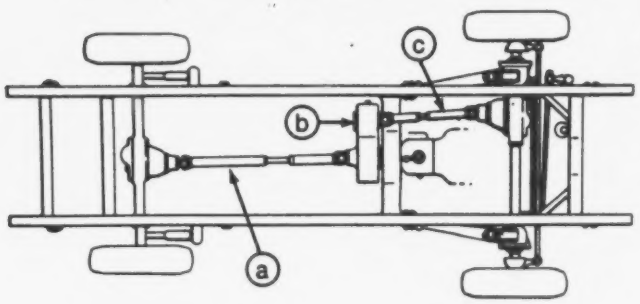
8. Answer the following questions about acceleration-deceleration of a propeller shaft equipped with a cross and roller U-joint. Write the correct answers in the blanks.

   a. Does the input side of the joint turn at a constant speed or at a variable speed? Constant

   b. How many times does the output side of the joint accelerate during one revolution of the shaft? Two

   c. Is is true or false that the greater the U-joint running angle is, the greater the effect will be? True

9. Identify the major components of the four-wheel drive illustrated below. Write the correct names in the blanks.



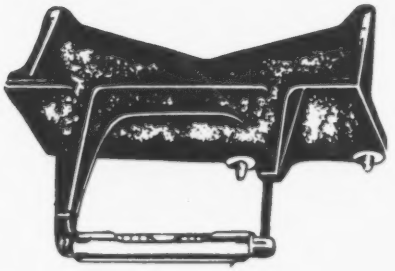
a. Rear propeller shaft

b. Transfer case

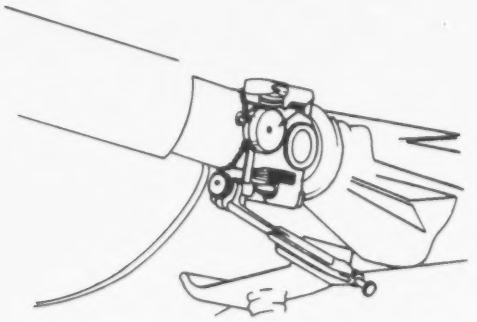
c. Front propeller shaft

10. Identify the tools used in drive line repair that are illustrated below. Write the correct names in the blanks.

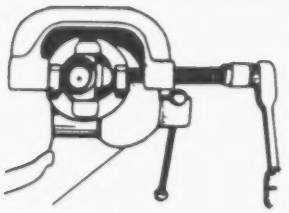
U-joint hand press
Inclinometer
Dial indicator for shaft runout
Hydraulic press tool



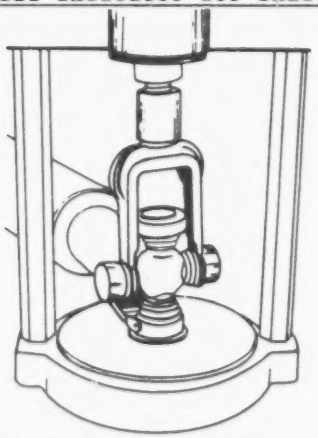
a. Inclinometer



b. Dial indicator for shaft runout



c. U-joint hand press



d. Hydraulic press tool

11. Select from the following list methods of controlling drive line vibration. Write an "X" in the blank before each correct answer.

    ____a. Carrier bearing reinforcement

    _X_ b. Vibration absorber

    _X_ c. Constant velocity U-joint

    ____d. Ball and trunnion U-joint

    ____e. Cross and roller U-joint

    _X_ f. Elastomer sleeved propeller shaft

    _X_ g. Torsional vibration damper

12. Stop. Have your instructor evaluate your pretest and mark the area(s) below requiring additional study.

    Refer to Information Sheet, Section(s):

I _____	VII _____
II _____	VIII _____
III _____	IX _____
IV _____	X _____
V _____	XI _____
VI _____	

    You came here from Learning Step 2. If none of the above Sections are checked, proceed to Learning Step 7. Otherwise, continue to Learning Step 3.

SECTION C--DRIVE TRAIN
UNIT III--DRIVE LINES

LAP ASSIGNMENT SHEET #1

NAME _____ SCORE _____

1. Match terms and definitions associated with drive trains. Write the correct terms in the blanks.

Cardan joint	Propeller shaft
Drive line	Slip joint
U-joint timing	U-joint (universal joint)
Constant velocity U-joint	Whirl

a. **Slip joint** --Variable-length connection at one end of a propeller shaft that allows the shaft to vary in length as the vehicle body moves up and down in relation to the rear axle

b. **Drive line** --Driving connection made up of one or more propeller shafts between transmission and differential

c. **U-joint timing** --Procedure of aligning the yokes of a two or more piece propeller shaft to help control whirl and vibration in the propeller shaft

d. **U-joint (universal joint)** --Coupling that allows power to be transferred through an angle

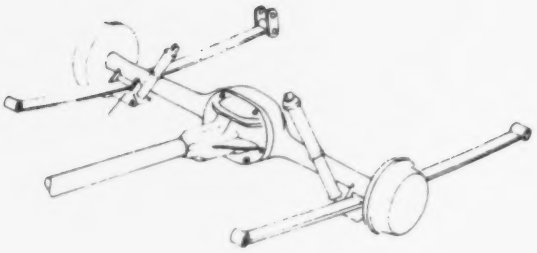
e. **Propeller shaft** --Shaft that connects the transmission to the rear axle to propel the vehicle

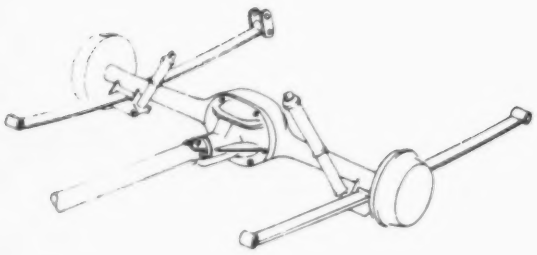
f. **Whirl** --Propeller shaft runout or unbalanced condition causing the shaft to act similar to the looping action of a rope held at both ends and swung in an arc

g. **Cardan joint** --Cross and roller U-joint

h. **Constant velocity U-joint** --Two closely coupled cross and roller U-joints arranged so that their acceleration-deceleration effects cancel each other, resulting in output propeller shaft speed identical to input speed

2. Label the types of drive lines illustrated below. Write the correct names in the blanks.

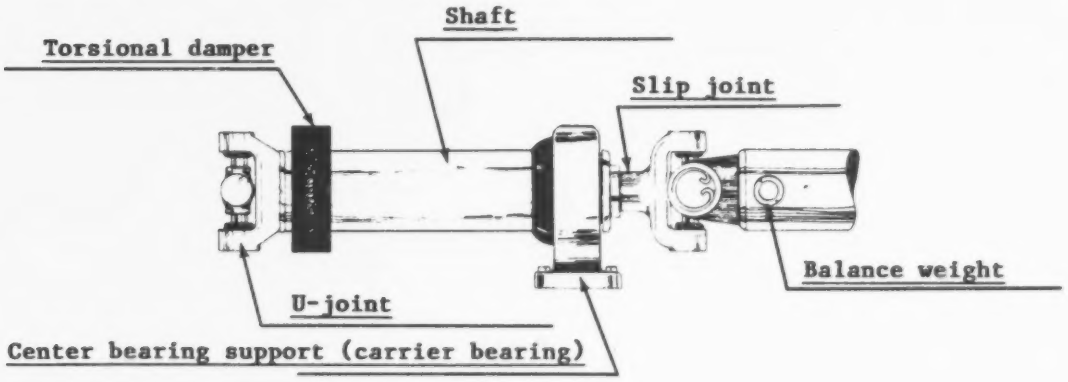




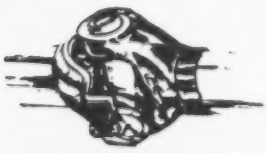
a. Torque-tube drive (closed propeller shaft)

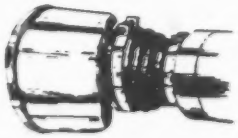
b. Hotchkiss drive (open propeller shaft)

3. Label the components of the propeller shaft illustrated below. Write the correct names in the blanks.



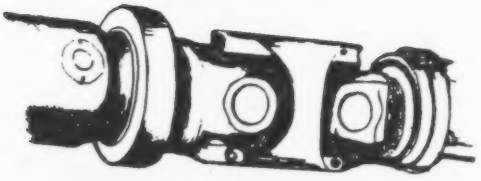
4. Label the following illustrations of types of U-joints. Write the correct names in the blanks.





a. Cross and roller

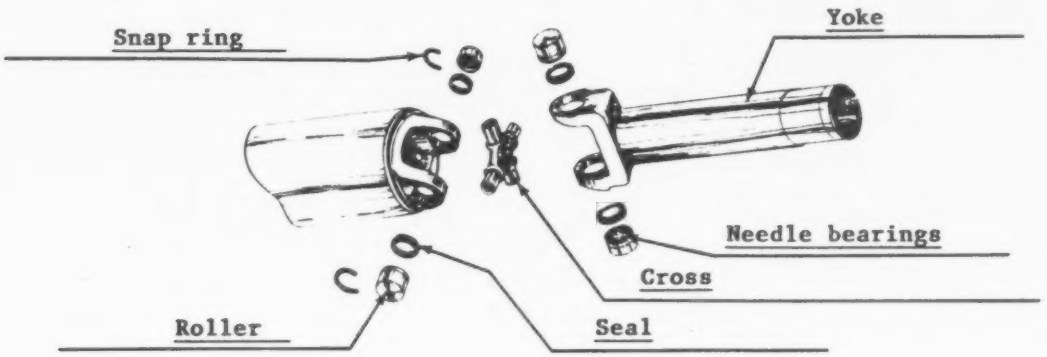
b. Ball and trunnion



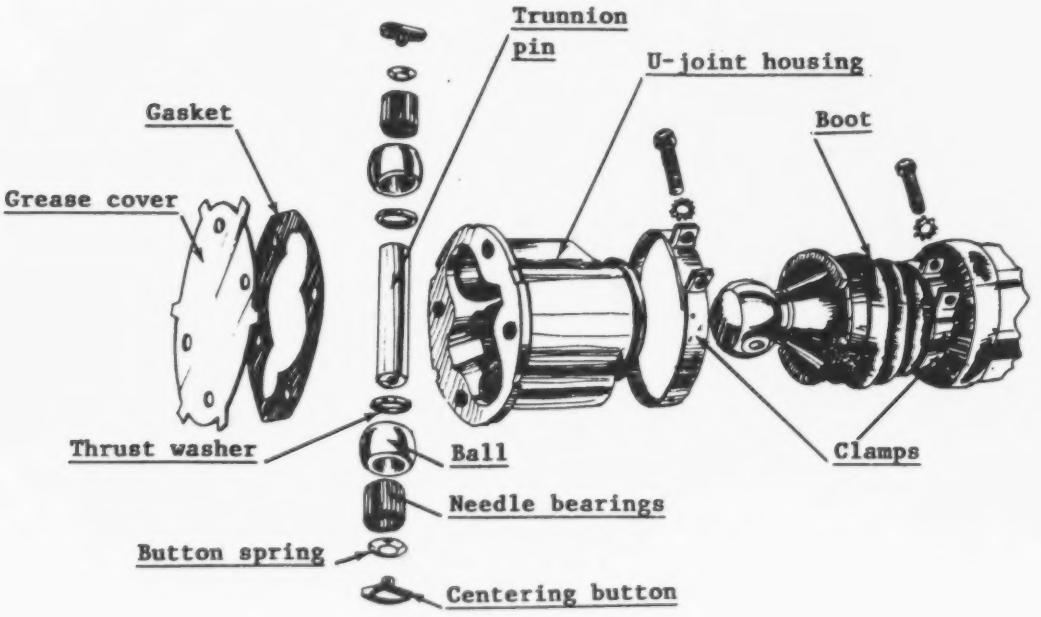
c. **Constant velocity** d. **Rzeppa**

5. Identify the parts of the cross and roller U-joint illustrated below. Write the correct names in the blanks.

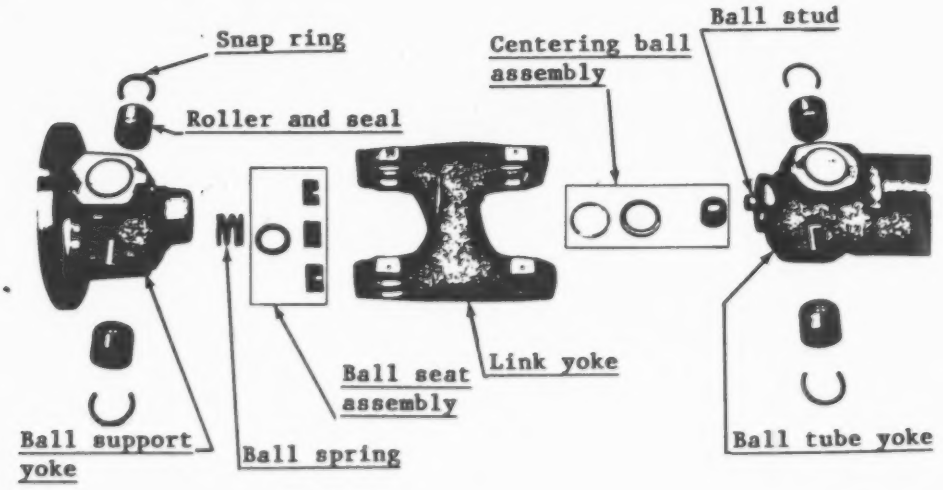
Cross	Roller
Roller	Yoke
Snap ring	Needle bearings



6. Label the parts of the ball and trunnion U-joint illustrated below. Write the correct names in the blanks.



7. Label the parts of the constant velocity U-joint illustrated below. Write the correct names in the blanks.



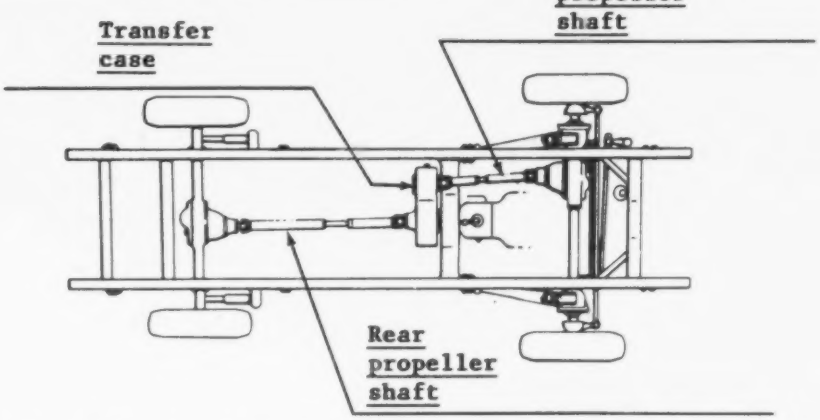
8. Discuss the acceleration-deceleration of a propeller shaft equipped with a cross and roller U-joint.

   a. Input side of joint turns at constant speed

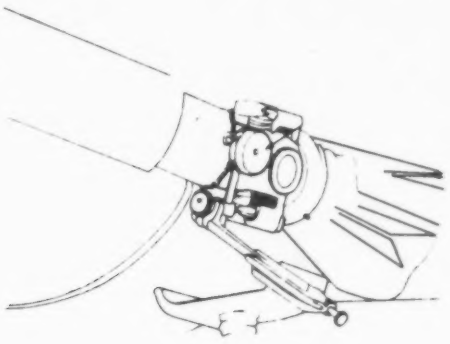
   b. Output side of the joint accelerates and decelerates twice during one revolution of the shaft

   c. The greater the U-joint running angle is, the greater the effect will be

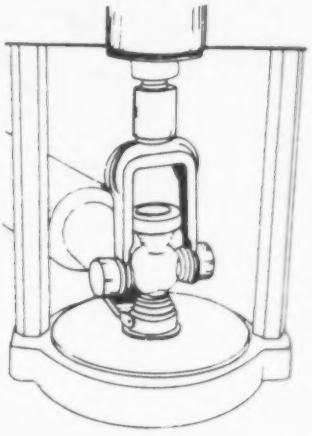
9. Label the major components of the four-wheel drive illustrated below. Write the correct names in the blanks.



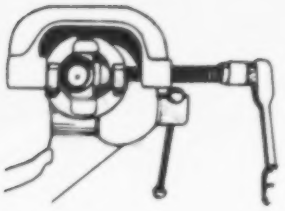
10. Label the following illustrations of tools used in drive line repair. Write the correct names in the blanks.

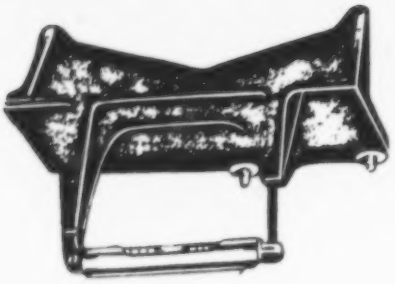


a. Dial indicator for shaft runout



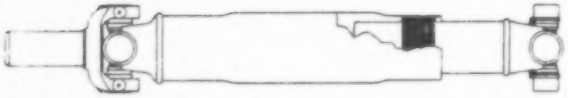
b. Hydraulic press tool

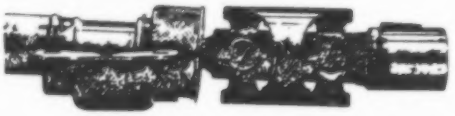




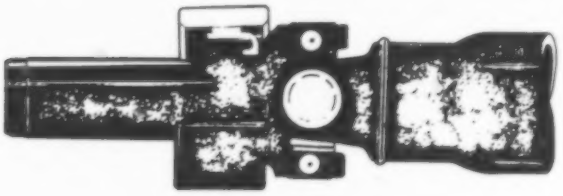
c. U-joint hand press d. Inclinometer

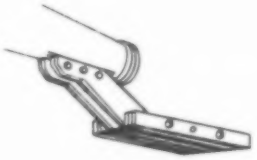
11. Label the following illustrations of methods of controlling drive line vibration. Write the correct names in the blanks.





a. Elastomer-sleeved propeller shaft b. Constant velocity U-joint





c. Torsional vibration damper d. Vibration absorber

12. Stop. Have your instructor evaluate your Assignment Sheet and mark the area(s) below requiring additional study.

Refer to Information Sheet, Section(s):

I _____	V _____	IX _____
II _____	VI _____	X _____
III _____	VII _____	XI _____
IV _____	VIII _____	

If none of the above sections are checked, proceed to Learning Step 7. Otherwise, continue to Learning Step 6.

SECTION C--DRIVE TRAINS
UNIT III--DRIVE LINES

LAP ASSIGNMENT SHEET #2

NAME _____ SCORE _____

1. Fill in the blanks to complete the following definitions.

   a. Drive line--__Driving__ __connection__ made up of one or more __propeller__ __shafts__ between __transmission__ and __differential__.

   b. Propeller shaft--Shaft that connects the __transmission__ to the __rear__ __axle__ to propel the vehicle.

   c. U-joint (universal joint)--__Coupling__ that allows power to be transferred through an __angle__.

   d. Constant velocity U-joint--Two closely coupled __cross__ __and__ __roller__ U-joints arranged so that their __acceleration__-__deceleration__ effects cancel each other, resulting in output propeller shaft speed __identical__ to input speed.

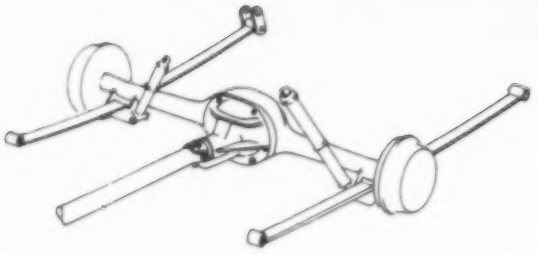
   e. Slip joint--__Variable__-__length__ connection at one end of a propeller shaft that allows the shaft to vary in __length__ as the vehicle body moves up and down in relation to the __rear__ __axle__.

   f. Cardan joint--__Cross__ __and__ __roller__ U-joint.

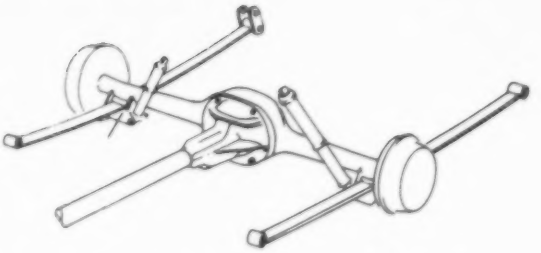
   g. Whirl--Propeller shaft __runout__ or unbalanced condition causing the shaft to act similar to the __looping__ __action__ __of__ __a__ __rope__.

h. U-joint timing--Procedure of aligning the yokes of a two or more piece propeller shaft to help control whirl and vibration in the propeller shaft

2. Label types of drive lines illustrated below. Write the correct names in the blanks.

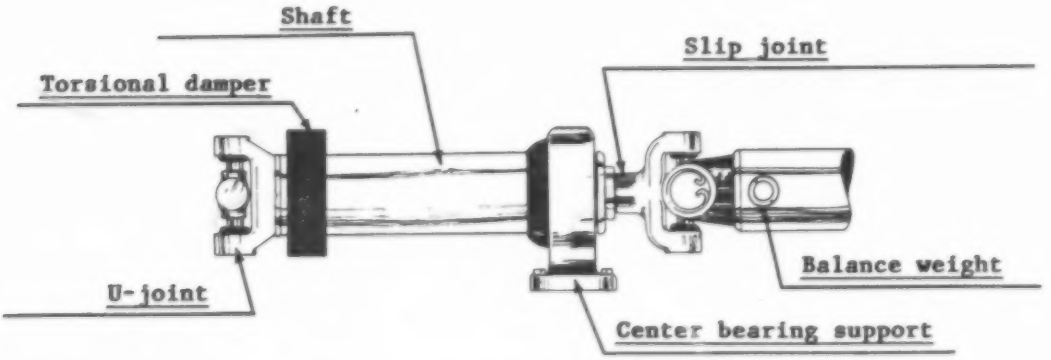


a. Hotchkiss drive (open propeller shaft)

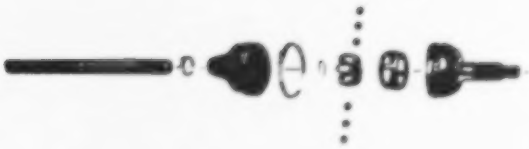


b. Torque-tube drive (closed propeller shaft)

3. Label the components of the propeller shaft illustrated below. Write the correct names in the blanks.



4. Label the types of U-joints illustrated below. Write the correct names in the blanks.



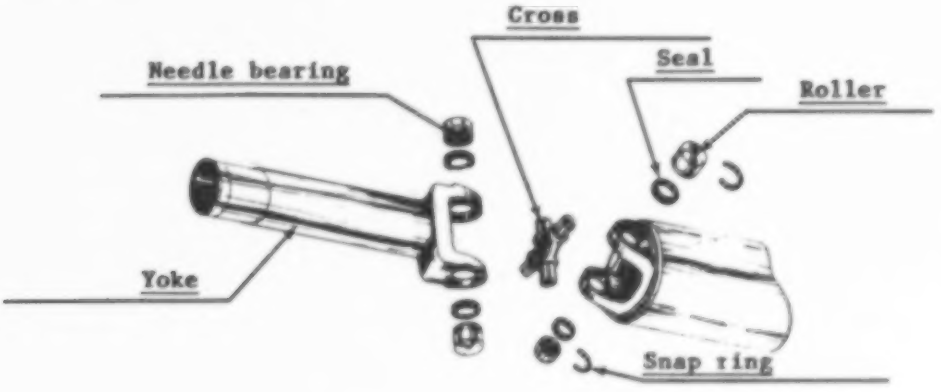
a. Rzeppa

b. Ball and trunnion

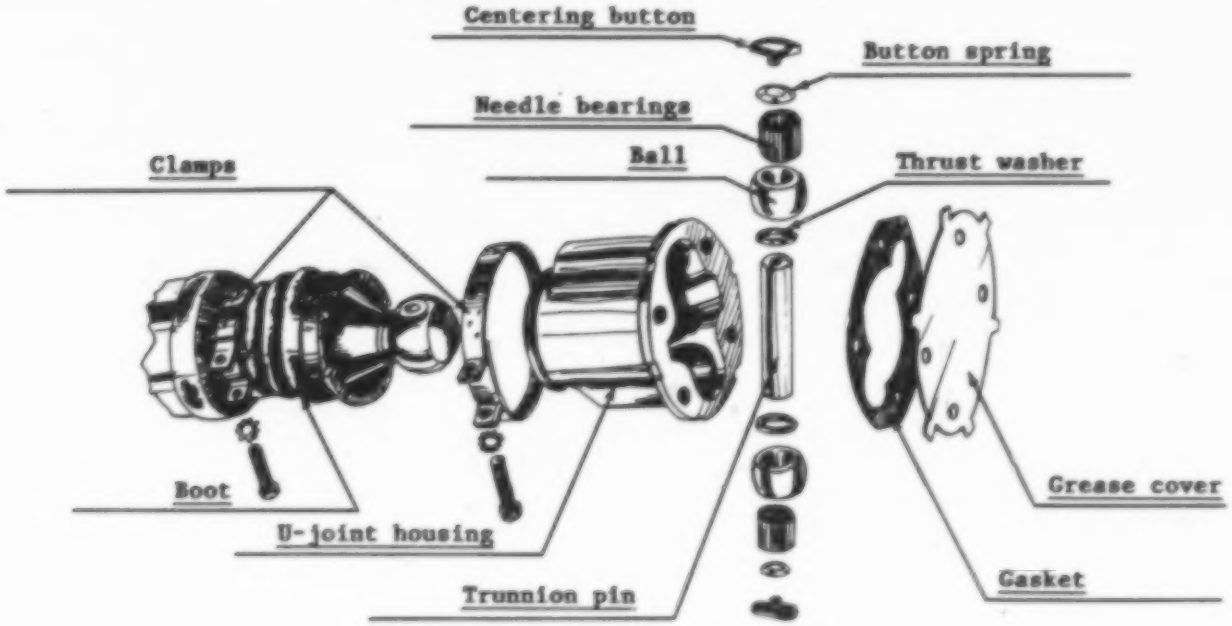
c. Constant velocity

d. Cross and roller

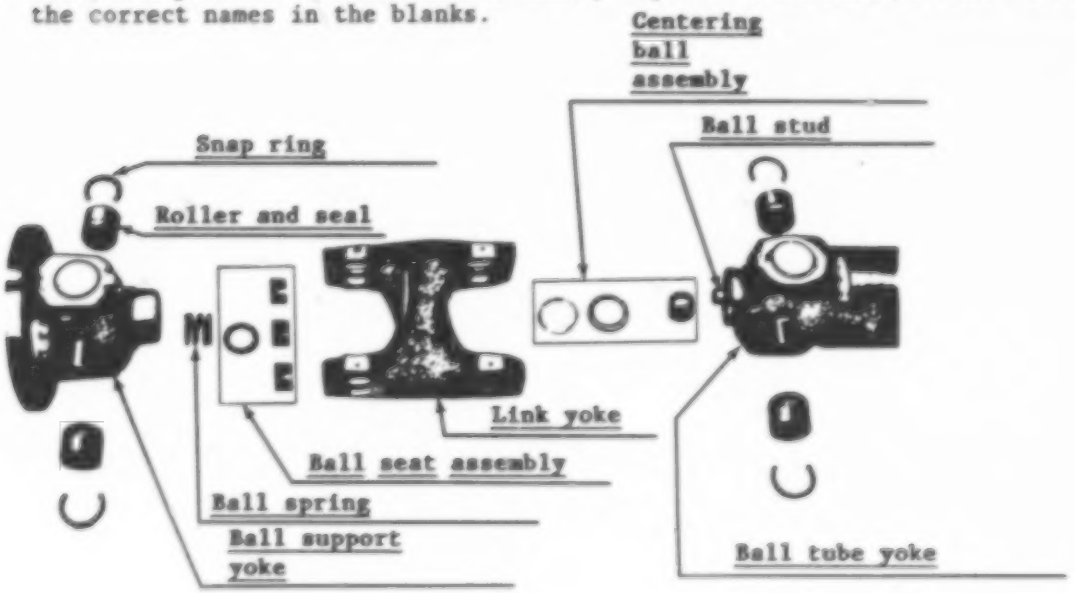
5. Label the parts of the cross and roller U-joint illustrated below. Write the correct names in the blanks.



6. Label the parts of the ball and trunnion U-joint illustrated below. Write the correct names in the blanks.



7. Label the parts of the constant velocity U-joint illustrated below. Write the correct names in the blanks.



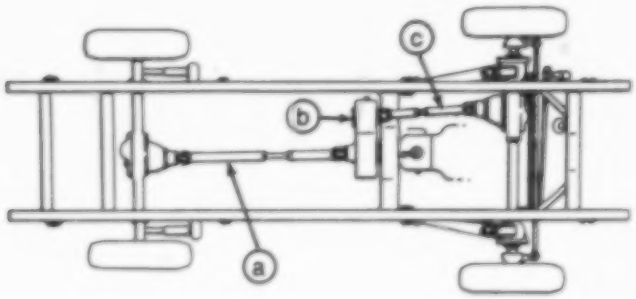
8. Select from the following list correct statements about the acceleration-deceleration of a propeller shaft equipped with a cross and roller U-joint. Write an "X" in the blank before each correct answer.

   __X__ The greater the U-joint running angle is, the greater the effect will be

   _____ Output side of the joint accelerates and decelerates three times during one revolution of the shaft

   _____ Input side of joint turns at variable speed

9. Name the major components of the four-wheel drive illustrated below. Write the correct names in the blanks.

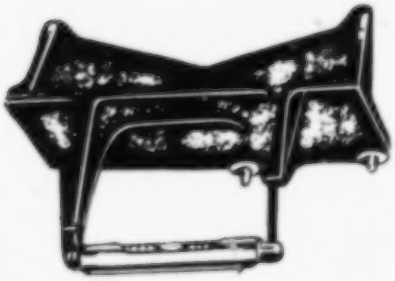


a. Rear propeller shaft

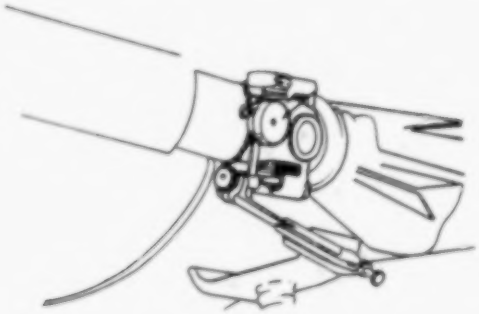
b. Transfer case

c. Front propeller shaft

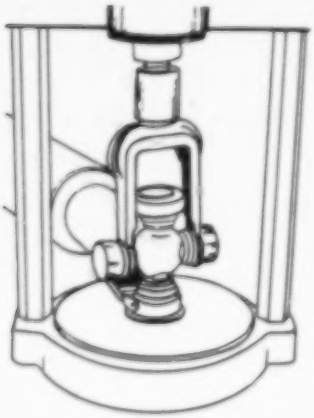
10. Label the following illustrations of tools used in drive line repair. Write the correct names in the blanks.



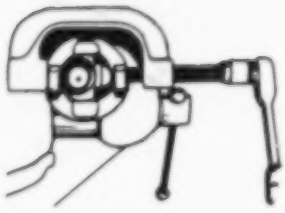
a. Inclinometer



b. Dial indicator



c. Hydraulic press tool



d. U-joint hand press

11. List methods of controlling drive line vibration.

a. Elastomer sleeved propeller shaft

b. Torsional vibration damper

c. Constant velocity U-joint

d. Vibration absorber

12. Stop. Have your instructor evaluate your Assignment Sheet. If your instructor is satisfied with your progress, continue to Learning Step 7. If additional study is required, discuss a program with your instructor. Once you have completed that program to your instructor's satisfaction, continue to Learning Step 7.

State Department of Vocational and Technical Education CIMC Stillwater, Oklahoma LEARNING ACTIVITY PACKETS

for AUTO MECHANICS II

LAP NO._____ CODE:_____

MAJOR INSTRUCTIONAL AREA SECTION C--DRIVE TRAIN

INSTRUCTIONAL UNIT UNIT IV--REAR AXLE

LEARNING ACTIVITY PACKET NO. 18

PREREQUISITE LAP(S) 17

PURPOSE: This Learning Activity Packet (LAP) outlines the study activities and performance tasks for "Rear Axle." Accomplishing these procedures will aid the student in attaining a working knowledge of this area of training and in achieving a Skilled or Moderately Skilled competency level in the performance of jobs associated with this specialty.

INTRODUCTION: The course of study in this LAP will help the student become able to identify the components of the rear axle assembly and discuss its purposes, and to remove, repair, and replace the rear axle assembly.

TASKS INCLUDED IN THIS LAP:

1. Measure backlash between ring gear and drive pinion.
2. Test ring gear and drive pinion gear tooth contact pattern.
3. Replace drive pinion seal.
4. Replace ball bearing type rear axle shaft bearing and seal.
5. Adjust drive pinion bearing preload with carrier assembly removed.
6. Select pinion depth spacer with a pinion depth gauge.
7. Adjust backlash and carrier bearing preload.
8. Remove and replace rear axle housing assembly.
9. Disassemble, inspect, reassemble, and adjust an integral carrier rear axle.

SECTION C--DRIVE TRAIN
UNIT IV--REAR AXLE

LEARNING STEPS

Check the following blanks as you complete the required steps.

_____ 1. Read — Unit and Specific Objectives, pages AM II-159-C and 160-C.

_____ 2. Complete — Rear Axle Pretest, LAP page 13.

_____ 3. Study — The sections of the Information Sheet, pages AM II-163-C through 166-C, indicated by your instructor on your pretest.

_____ 4. Refer — To Step 11 of the pretest. If additional study is required, continue to Learning Step 5. Otherwise, proceed to Learning Step 7.

_____ 5. Do — LAP Assignment Sheet #1, LAP page 21.

_____ 6. Do — LAP Assignment Sheet #2, LAP page 29.

_____ 7. Check — The following tasks that you think you can perform without supervision.

Student Check		Instructor Initials/Date: Skilled	Moderately Skilled
_____a.	Measure backlash between ring gear and drive pinion (12)	_____	_____

LEARNING STEPS

Student Check		Instructor Initials/Date Skilled	Moderately Skilled
_____b.	Test ring gear and drive pinion gear tooth contact pattern (18)	_____	_____
_____c.	Replace drive pinion seal (24)	_____	_____
_____d.	Replace ball bearing type rear axle shaft bearing and seal (30)	_____	_____
_____e.	Adjust drive pinion bearing preload with carrier assembly removed (36)	_____	_____
_____f.	Select pinion depth spacer with a pinion depth gauge (42)	_____	_____
_____g.	Adjust backlash and carrier bearing preload (48)	_____	_____
_____h.	Remove and replace rear axle housing assembly (54)	_____	_____
_____i.	Disassemble, inspect, reassemble, and adjust an integral carrier rear axle (60)	_____	_____

_____ 8. Discuss — Your competency in each task with your instructor. Your instructor will initial each task in which you demonstrate sufficient competency. If all tasks have been initialed by your instructor, proceed to Learning Step 63. Otherwise, continue to Learning Step 9.

_____ 9. Refer — To Learning Step 7a. If this task has been initialed by your instructor, proceed to Learning Step 15. Otherwise, continue to Learning Step 10.

_____10. Study — Job Sheet #1--Measure Backlash Between Ring Gear and Drive Pinion, page AM II-189-C.

LEARNING STEPS

_____11.	Watch	Slide/tape presentation, "Measure Backlash Between Ring Gear and Drive Pinion" (C-IV-1).
_____12.	Do	Job Sheet #1--Measure Backlash Between Ring Gear and Drive Pinion.
_____13.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 7a and proceed to Learning Step 15. Otherwise, repeat Learning Steps 10 through 12 and then continue to Learning Step 14.
_____14.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 7a and continue to Learning Step 15. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 7a and then continue to Learning Step 15.
_____15.	Refer	To Learning Step 7b. If this task has been initialed by your instructor, proceed to Learning Step 21. Otherwise, continue to Learning Step 16.
_____16.	Study	Job Sheet #2--Test Ring Gear and Drive Pinion Gear Tooth Contact Pattern, page AM II-191-C.
_____17.	Watch	Slide/tape presentation, "Test Ring Gear and Drive Pinion Gear Tooth Contact Pattern (C-IV-2).
_____18.	Do	Job Sheet #2--Test Ring Gear and Drive Pinion Gear Tooth Contact Pattern.

_____19.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 7b and proceed to Learning Step 21. Otherwise, repeat Learning Steps 16 through 18 and then continue to Learning Step 20.
_____20.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 7b and continue to Learning Step 21. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 7b and then continue to Learning Step 21.
_____21.	Refer	To Learning Step 7c. If this task has been initialed by your instructor, proceed to Learning Step 27. Otherwise, continue to Learning Step 22.
_____22.	Study	Job Sheet #3--Replace Drive Pinion Seal, page AM II-195-C.
_____23.	Watch	Slide/tape presentation, "Replace Drive Pinion Seal" (C-IV-3).
_____24.	Do	Job Sheet #3--Replace Drive Pinion Seal.
_____25.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 7c and proceed to Learning Step 27. Otherwise, repeat Learning Steps 22 through 24 and then continue to Learning Step 26.

_____26.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 7c and continue to Learning Step 27. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 7c and then continue to Learning Step 27.
_____27.	Refer	To Learning Step 7d. If this task has been initialed by your instructor, proceed to Learning Step 33. Otherwise, continue to Learning Step 28.
_____28.	Study	Job Sheet #4--Replace Ball Bearing Type Rear Axle Shaft Bearing and Seal, page AM II-200-C.
_____29.	Watch	Slide/tape presentation, "Replace Ball Bearing Type Rear Axle Shaft Bearing and Seal" (C-IV-4).
_____30.	Do	Job Sheet #4--Replace Ball Bearing Type Rear Axle Shaft Bearing and Seal.
_____31.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 7d and proceed to Learning Step 33. Otherwise, repeat Learning Steps 28 through 30 and then continue to Learning Step 32.
_____32.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 7d and continue to Learning Step 33. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 7d and then continue to Learning Step 33.

_____33.	Refer	To Learning Step 7e. If this task has been initialed by your instructor, proceed to Learning Step 39. Otherwise, continue to Learning Step 34.
_____34.	Study	Job Sheet #5--Adjust Drive Pinion Bearing Preload with Carrier Assembly Removed, page AM II-205-C.
_____35.	Watch	Slide/tape presentation, "Adjust Drive Pinion Bearing Preload with Carrier Assembly Removed" (C-IV-5).
_____36.	Do	Job Sheet #5--Adjust Drive Pinion Bearing Preload with Carrier Assembly Removed.
_____37.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 7e and proceed to Learning Step 39. Otherwise, repeat Learning Steps 34 through 36 and then continue to Learning Step 38.
_____38.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 7e and continue to Learning Step 39. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 7e and then continue to Learning Step 39.
_____39.	Refer	To Learning Step 7f. If this task has been initialed by your instructor, proceed to Learning Step 45. Otherwise, continue to Learning Step 40.
_____40.	Study	Job Sheet #6--Select Pinion Depth Spacer with a Pinion Depth Gauge, page AM II-209-C.

LEARNING STEPS

_____41.	Watch	Slide/tape presentation, "Select Pinion Depth Spacer with a Pinion Depth Gauge" (C-IV-6).
_____42.	Do	Job Sheet #6--Select Pinion Depth Spacer with a Pinion Depth Gauge.
_____43.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 7f and proceed to Learning Step 45. Otherwise, repeat Learning Steps 40 through 42 and then continue to Learning Step 44.
_____44.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 7f and continue to Learning Step 45. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 7f and then continue to Learning Step 45.
_____45.	Refer	To Learning Step 7g. If this task has been initialed by your instructor, proceed to Learning Step 51. Otherwise, continue to Learning Step 46.
_____46.	Study	Job Sheet #7--Adjust Backlash and Carrier Bearing Preload, page AM II-213-C.
_____47.	Watch	Slide/tape presentation, "Adjust Backlash and Carrier Bearing Preload" (C-IV-7).
_____48.	Do	Job Sheet #7--Adjust Backlash and Carrier Bearing Preload.

LEARNING STEPS

_____49.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 7g and proceed to Learning Step 51. Otherwise, repeat Learning Steps 46 through 48 and then continue to Learning Step 50.
_____50.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 7g and continue to Learning Step 51. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 7g and then continue to Learning Step 51.
_____51.	Refer	To Learning Step 7h. If this task has been initialed by your instructor, proceed to Learning Step 57. Otherwise, continue to Learning Step 52.
_____52.	Study	Job Sheet #8--Remove and Replace Rear Axle Housing Assembly, page AM II-125-C.
_____53.	Watch	Slide/tape presentation, "Remove and Replace Rear Axle Housing Assembly" (C-IV-8).
_____54.	Do	Job Sheet #8--Remove and Replace Rear Axle Housing Assembly.
_____55.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 7h and proceed to Learning Step 57. Otherwise, repeat Learning Steps 52 through 54 and then continue to Learning Step 56.

_____56.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 7h and continue to Learning Step 57. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 7h and then continue to Learning Step 57.
_____57.	Refer	To Learning Step 7i. If this task has been initialed by your instructor, proceed to Learning Step 63. Otherwise, continue to Learning Step 58.
_____58.	Study	Job Sheet #9--Disassemble, Inspect, Reassemble, and Adjust an Integral Carrier Rear Axle, page AM II-219-C.
_____59.	Watch	Slide/tape presentation, "Disassemble, Inspect, Reassemble, and Adjust an Integral Carrier Rear Axle" (C-IV-9).
_____60.	Do	Job Sheet #9--Disassemble, Inspect, Reassemble, and Adjust an Integral Carrier Rear Axle.
_____61.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 7i and proceed to Learning Step 63. Otherwise, repeat Learning Steps 58 through 60 and then continue to Learning Step 62.
_____62.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 7i and continue to Learning Step 63. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 7i and then continue to Learning Step 63.

LEARNING STEPS

_____63.	Review	Information Sheet (pages AM II-163-C through 166-C) and LAP Assignment Sheets.
_____64.	Take	Rear Axle Test (see your instructor). If your score is 85 percent or above, continue to the next assigned Learning Activity Packet. Otherwise, ask your instructor about additional study requirements and possible retesting.

SECTION C--DRIVE TRAIN
UNIT IV--REAR AXLE

PRETEST

NAME _____ SCORE _____

DIRECTIONS: This pretest is to determine how much you already know about a rear axle. Your performance on this pretest will not be used to determine your grade in the course. Instead, it will guide your instructor in designing this course to meet your needs. If you are unsure of the answer to a question, do not guess. Guessing may prevent you from receiving needed instruction.

1. State purposes of the rear axle assembly.

   a. To change the direction of power flow

   b. To provide a means for the vehicle to corner without the rear wheels skidding

2. Match terms and definitions associated with the rear axle. Write the correct numbers in the blanks.

3 a.	Solution that indicates the area of contact between gear teeth; can be made of red lead and motor oil, white lead, or Prussian blue	1. Differential
1 b.	Unit that will drive both rear wheels at the same time but will allow them to turn at different speeds when negotiating turns	2. Nonslip differential
2 c.	Special traction differential that automatically transfers torque to the wheel that is not slipping when loss of drive force occurs in the other wheel	3. Pattern paste
4 d.	Distance separating two gear teeth that are meshed together	4. Gear tooth clearance
5 e.	Distance that one gear can be moved back and forth without moving the gear into which it is meshed	5. Backlash

6	f.	Set of gears in which the drive pinion gear is below the center of the ring gear
9	g.	Axle drives the wheel; wheel is supported and retained by a hub containing two roller bearings which are attached to the axle housing
8	h.	Adjustment of antifriction bearings so that they are under mild pressure; tested by the amount of torque in inch pounds required to turn the shaft
7	i.	Set of gears in which any one drive pinion gear tooth contacts only a certain number of ring gear teeth; set with timing marks on the gear teeth
11	j.	Axle supports, retains, and drives the wheel; outer end of axle is supported by a bearing in the axle housing
10	k.	Method used to test the wiping action between the ring gear and drive pinion gear teeth to determine if they are properly adjusted
12	l.	Axle retains and drives the wheel; load is supported by means of a hub and bearing assembly on the axle housing

6. Hypoid gearing
7. Nonhunting gears
8. Preload
9. Full-floating axle
10. Tooth contact pattern test
11. Semifloating axle
12. Three-quarter floating axle

3. Identify the parts of the gear tooth illustrated below. Write the correct names in the blanks.

Toe	Clearance
Backlash	Pitch line
Face	Flank
Heel	

a. Backlash

b. Toe

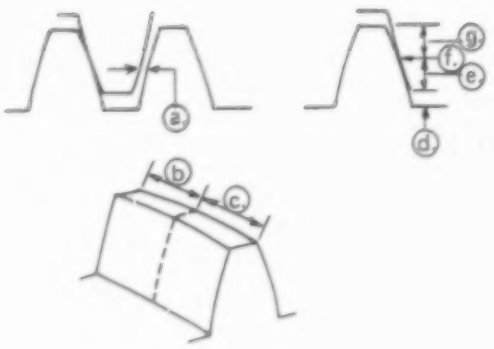
c. Heel

d. Clearance

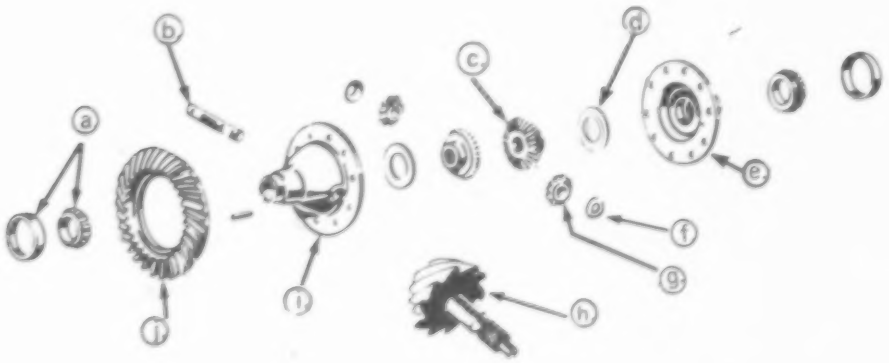
e. Flank

f. Pitch line

g. Face



4. Identify the parts of the conventional differential illustrated below. Write the correct letters in the blanks.



d Side gear thrust washer

e Case cover

f Pinion gear thrust cover

h Drive pinion gear

a Carrier bearings

i Differential case

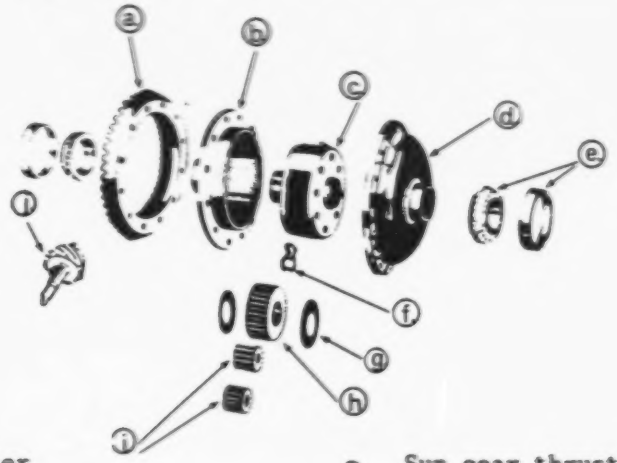
b Pinion shaft

c Side gear

j Ring gear

g Pinion gear

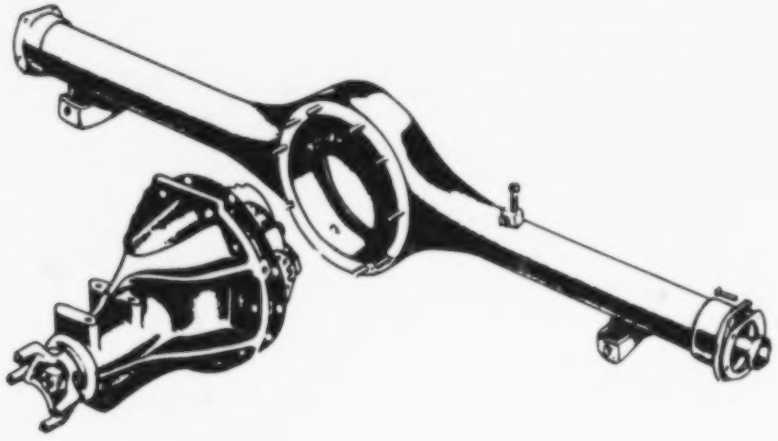
5. Identify the parts of the planetary differential illustrated below. Write the correct letters in the blanks.



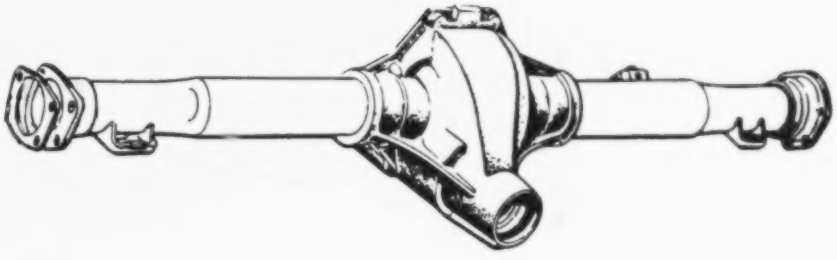
c	Planet carrier	g	Sun gear thrust washer
f	Axle retainer washer	j	Drive pinion gear
e	Side bearings	a	Ring gear
h	Sun gear	d	Case cover
b	Internal gear and differential case	i	Planet pinion gears

6. Identify the types of differential carrier housings illustrated below. Write the correct names in the blanks.

Removable carrier Integral carrier



Removable carrier



Integral carrier

7. Discuss the ideal ring gear and drive pinion tooth contact pattern.

   a. On drive side of tooth (convex side)

   Should be centrally located between the top and bottom; can be slightly closer to the toe end; tends to spread toward the heel of the tooth as the load increases

   b. On coast side of tooth (concave side)

   Should be centrally located between the top and bottom; may be a little longer and slightly closer to the toe end

8. Match types of gear tooth contact patterns and their illustrations. Write the correct letters in the blanks.

e High tooth contact

b Toe contact

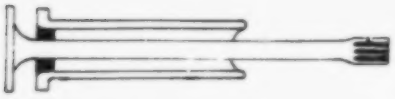
d Ideal tooth contact

a Low tooth contact

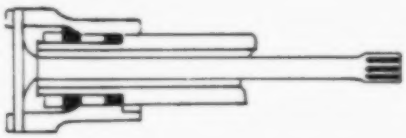
c Heel contact

9. Identify the types of rear axle shafts illustrated below. Write the correct names in the blanks.

Semi-floating Three-quarter floating Full-floating



Semifloating



Full-floating

Three-quarter floating

10. List types of rear axle bearings.

a. Ball bearing

b. Tapered roller bearing

c. Flat roller bearing

11. Stop. Have your instructor evaluate your pretest and mark the area(s) below requiring additional study.

Refer to Information Sheet, Section(s)

I ____	VI ____
II ____	VII ____
III ____	VIII ____
IV ____	IX ____
V ____	X ____

You came here from Learning Step 2. If none of the above sections are checked, proceed to Learning Step 7. Otherwise, continue to Learning Step 3.

SECTION C--DRIVE TRAIN
UNIT IV--REAR AXLE

LAP ASSIGNMENT SHEET #1

NAME _____ SCORE _____

1. Fill in the blanks to complete statements concerning the purposes of the rear axle assembly.

   a. To change the direction of **power** **flow**

   b. To provide a means by which the vehicle can **corner**

      without the rear wheels **skidding**

2. Match terms and definitions associated with the rear axle. Write the correct terms in the blanks below their descriptions.

Full-floating axle	Differential	Hypoid gearing
Pattern paste	Backlash	Nonslip differential
Nonhunting gears	Preload	Gear tooth clearance
Three-quarter floating axle	Semifloating axle	Tooth contact pattern test

   a. Special traction differential that automatically transfers torque to the wheel that is not slipping when loss of drive force occurs in the other wheel

      Nonslip differential

   b. Unit that will drive both rear wheels at the same time but will allow them to turn at different speeds when negotiating turns

      Differential

   c. Set of gears in which any one drive pinion gear tooth contacts only a certain number of ring gear teeth; set with timing marks on the gear teeth

      Nonhunting gears

   d. Axle supports, retains, and drives the wheel; outer end of axle is supported by a bearing in the axle housing

      Semifloating axle

   e. Axle drives the wheel; wheel is supported and retained by a hub containing two roller bearings which are attached to the axle housing

      Full-floating axle

f. Axle retains and drives the wheel; load is supported by means of a hub and bearing assembly on the axle housing

Three-quarter floating axle

g. Distance that one gear can be moved back and forth without moving the gear into which it is meshed

Backlash

h. Solution that indicates the area of contact between gear teeth; can be made of red lead and motor oil, white lead, or Prussian blue

Pattern paste

i. Distance separating two gear teeth that are meshed together

Gear tooth clearance

j. Set of gears in which the drive pinion gear is below the center of the ring gear

Hypoid gearing

k. Adjustment of antifriction bearings so that they are under mild pressure; tested by the amount of torque in inch pounds required to turn the shaft

Preload

l. Method used to test the wiping action between the ring gear and drive pinion gear teeth to determine if they are properly adjusted

Tooth contact pattern tests

3. Label the parts of the gear tooth illustrated below. Write the correct names in the blanks.

a. **Backlash**

b. **Toe**

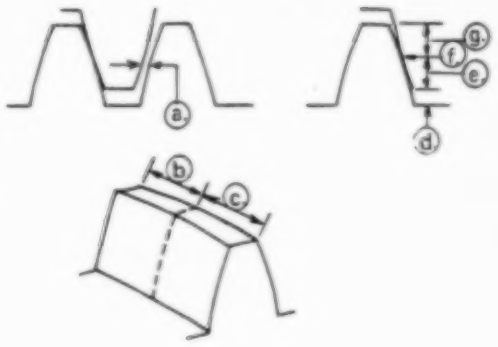
c. **Heel**

d. **Clearance**

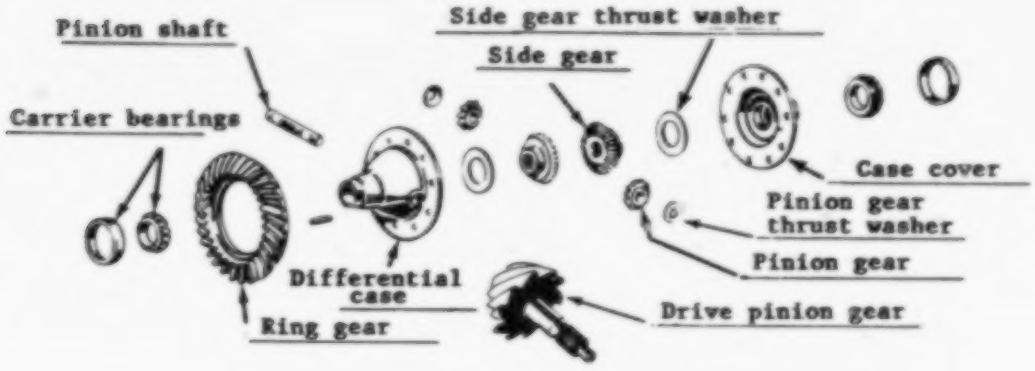
e. **Flank**

f. **Pitch line**

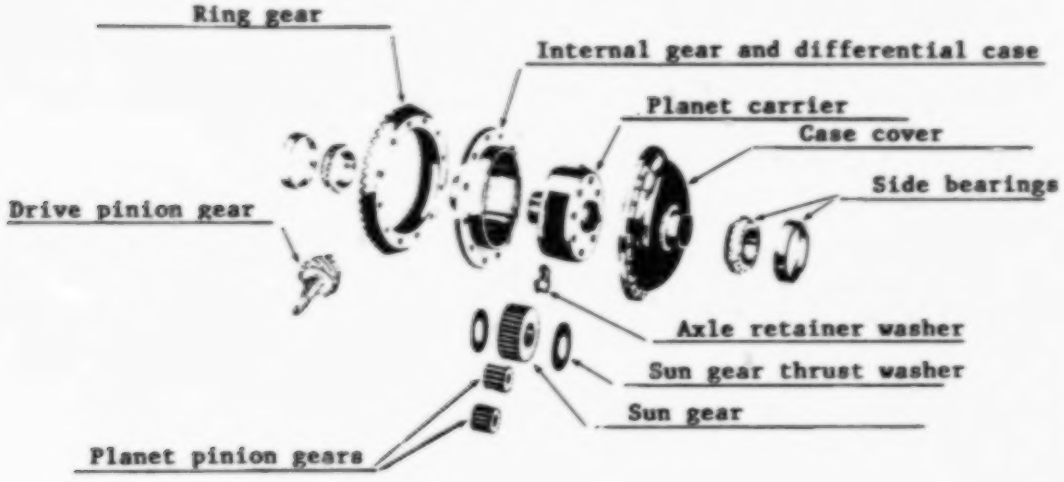
g. **Face**



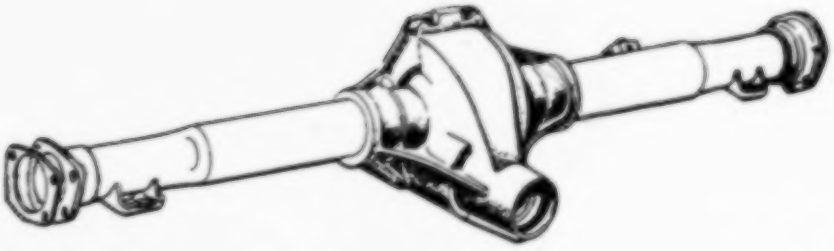
4. Label the parts of the conventional differential ilustrated below. Write the correct names in the blanks.



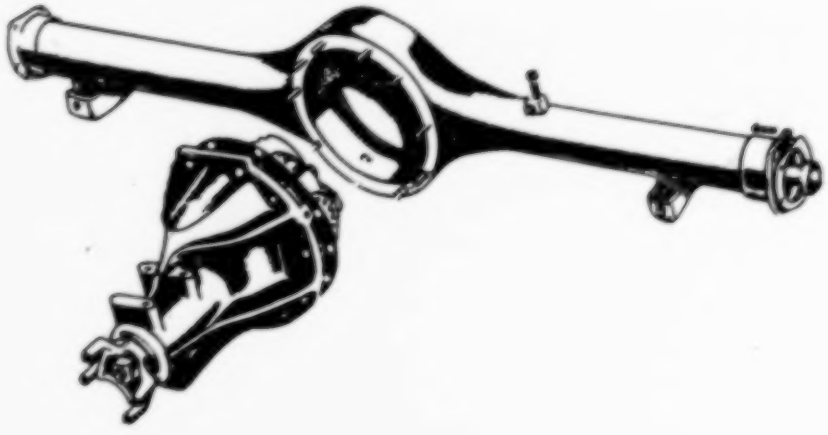
5. Label the parts of the planetary differential illustrated below. Write the correct names in the blanks.



6. Label the types of differential carrier housings illustrated below. Write the correct names in the blanks.



Integral carrier housing



Removable carrier housing

7. Fill in the blanks to complete statements about the characteristics of an ideal ring gear and drive pinion tooth contact pattern.

   a. On drive side of tooth (convex side)

      1) Should be centrally located between the top and bottom

      2) Can be slightly closer to the top end

      3) Tends to spread toward the heel of the tooth as the load increases

   b. On coast side of the tooth (concave side)

      1) Should be centrally located between the top and bottom

      2) May be a little longer and slightly closer to the toe end

8. Match types of gear tooth contact patterns to their correct diagrams. Write the correct numbers in the blanks.

__e__ Low tooth contact

__b__ High tooth contact

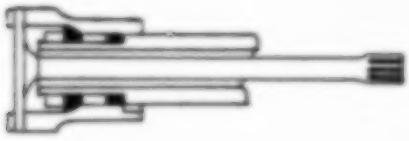
__a__ Ideal tooth contact

__c__ Toe contact

__d__ Heel contact

9. Label the types of rear axle shafts illustrated below. Write the correct names in the blanks.

Semifloating Three-quarter floating Full-floating



Full-floating

Three-quarter floating

Semifloating

10. List types of rear axle bearings.

a. Ball bearing

b. Tapered roller bearing

c. Flat roller bearing

11. Stop. Have your instructor evaluate your Assignment Sheet and mark the area(s) below requiring additional study.

Refer to Information Sheet, Section(s)

I ____	VI ____
II ____	VII ____
III ____	VIII ____
IV ____	IX ____
V ____	X ____

If none of the above sections are checked, proceed to Learning Step 7. Otherwise, continue to Learning Step 6.

SECTION C--DRIVE TRAIN
UNIT IV--REAR AXLE

LAP ASSIGNMENT SHEET #2

NAME _____ SCORE _____

1. State purposes of the rear axle assembly.

   a. To change the direction of power flow

   b. To provide a means for the vehicle to corner without the rear wheels skidding

2. Fill in the blanks to complete the following definitions.

   a. Hypoid gearing--Set of gears in which the drive pinion gear is below the center line of the ring gear

   b. Differential--Unit that will drive both rear wheels at the same time but will allow them to turn at different speeds when negotiating turns

   c. Backlash--Distance that one gear can be moved back and forth without moving the gear into which it is meshed

   d. Gear tooth clearance--Distance separating two gear teeth that are meshed together

   e. Preload--Adjustment of antifriction bearings so they are under mild pressure; tested by the amount of torque in inch pounds required to turn the shaft

f. Tooth contact pattern test--Method used to test the wiping action between the ring gear and the drive pinion gear teeth to determine if they are properly adjusted

g. Nonslip differential--Special traction differential that automatically transfers torque to the wheel that is not slipping when loss of drive force occurs in the other wheel

h. Pattern paste--Solution that indicates the area of contact between gear teeth; can be made of red lead and motor oil, white lead, or Prussian blue

i. Nonhunting gears--Set of gears in which any one drive pinion gear tooth contacts only a certain number of ring gear teeth; set with timing marks on the gear teeth

j. Semifloating axle--Axle supports, retains, and drives the wheel; outer end of axle is supported by a bearing in the axle housing

k. Three-quarter floating axle--Axle retains and drives the wheel; load is supported by means of a hub and bearing assembly on the axle housing

l. Full-floating axle--Axle drives the wheel; wheel is supported and retained by a hub containing two roller bearings which are attached to the axle housing

3. Identify the parts of the gear tooth illustrated below. Write the correct names in the blanks.

a. Backlash

b. Toe

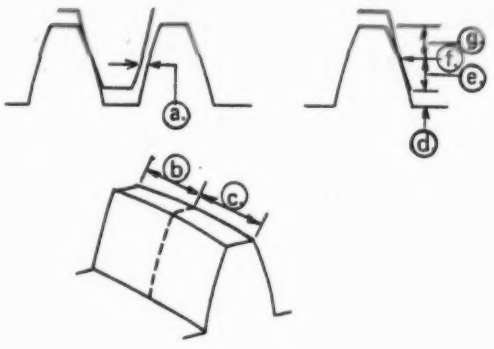
c. Heel

d. Clearance

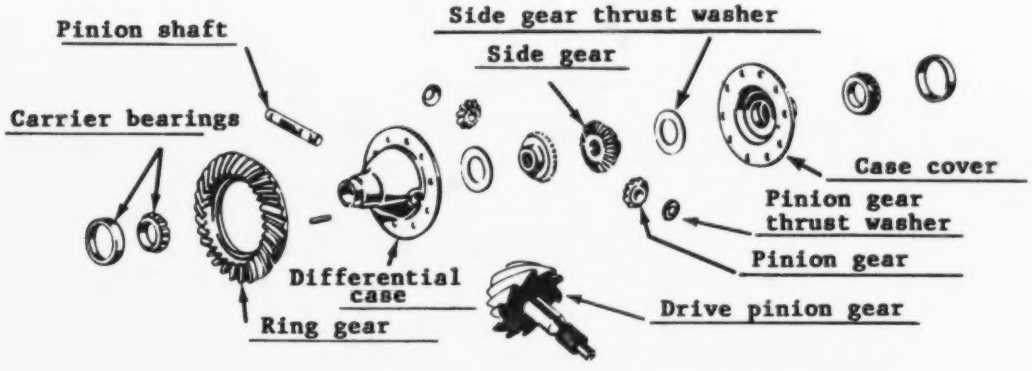
e. Flank

f. Pitch line

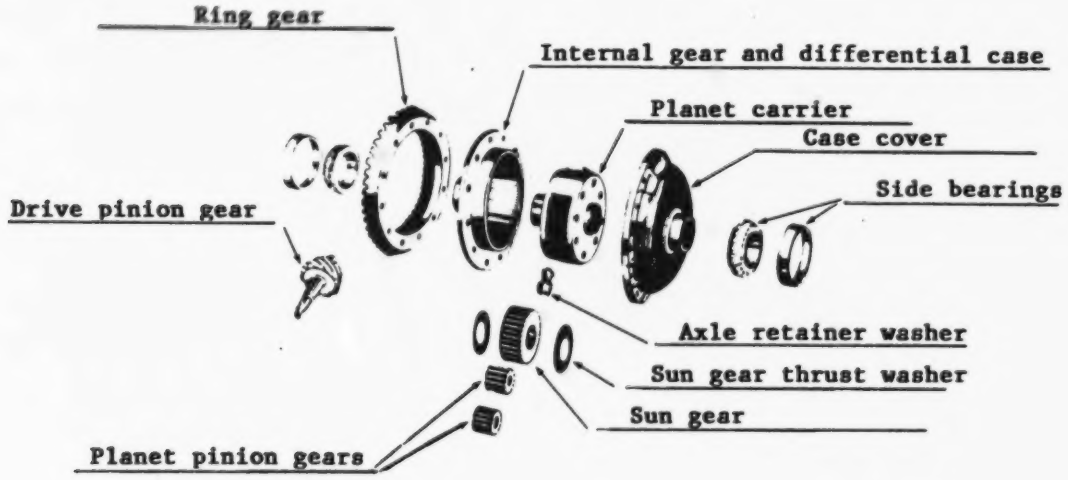
g. Face



4. Label the parts of the conventional differential illustrated below. Write the correct names in the blanks.



5. Label the parts of the planetary differential illustrated below. Write the correct names in the blanks.



6. Discuss the difference between a removable carrier and an integral carrier.

The removable carrier, sometimes called a third member, detaches from the housing for major repairs. The integral carrier and rear axle housing are manufactured as one unit, with a rear inspection cover for repairs.

7. Answer the following questions about the ideal ring gear and drive pinion tooth contact pattern.

   a. For both the drive side of the tooth and the coast side of the tooth, where should the pattern be located?

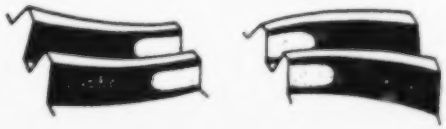
      Centrally, between the top and bottom

   b. Which side is concave? Toe

   c. On the drive side of the tooth, the patterns tend to spread in which direction as the load increases? Heel

8. Label types of ring gear tooth patterns. Write the correct names in the blanks.

a. Low tooth contact



b. Toe contact

c. Heel contact

d. Ideal tooth contact

e. High tooth contact

9. Name types of rear axle shafts.

a. Semifloating

b. Three-quarter floating

c. Full floating

10. Answer the following questions about types of rear axle bearings.

a. What are the two types of roller bearings?

1) Tapered

2) Flat

b. What is the shape of the third type? Ball

11. Stop. Have your instructor evaluate your Assignment Sheet. If your instructor is satisfied with your progress, continue to Learning Step 7. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, continue to Learning Step 7.

State Department of Vocational and Technical Education CIMC Stillwater, Oklahoma LEARNING ACTIVITY PACKETS

for AUTO MECHANICS II

LAP NO._____ CODE:_____

MAJOR INSTRUCTIONAL AREA SECTION C--DRIVE TRAIN

INSTRUCTIONAL UNIT UNIT V--AUTOMATIC TRANSMISSION SERVICE

LEARNING ACTIVITY PACKET NO. 19

PREREQUISITE LAP(S) 2, 8, 17

PURPOSE: This Learning Activity Packet (LAP) outlines the study activities and performance tasks for "Automatic Transmission Service." Accomplishing these procedures will aid the student in attaining a working knowledge of this area of training and in achieving a Skilled or Moderately Skilled competency level in the performance of jobs associated with this specialty.

INTRODUCTION: The course of study in this LAP will help the student become able to perform transmission tune-ups and conduct tests that require that the transmission be in the vehicle.

TASKS INCLUDED IN THIS LAP:

1. Perform a road test for transmission diagnosis.
2. Replace an extension housing bushing and seal.
3. Tune-up an automatic transmission.

SECTION C--DRIVE TRAIN
UNIT V--AUTOMATIC TRANSMISSION SERVICE

LEARNING STEPS

Check the following blanks as you complete the required steps.

_____ 1. Read — Unit and Specific Objectives, page AM II-239-C.

_____ 2. Complete — Automatic Transmission Service Pretest, LAP page 7.

_____ 3. Study — The sections of the Information Sheet, pages AM II-243-C through AM II-245-C, indicated by your instructor on your pretest.

_____ 4. Refer — To Step 9 of the pretest. If additional study is required, continue to Learning Step 5. Otherwise, proceed to Learning Step 7.

_____ 5. Do — LAP Assignment Sheet #1, LAP page 11.

_____ 6. Do — LAP Assignment Sheet #2, LAP page 17.

_____ 7. Check — The tasks below that you think you can perform without supervision.

Student Check			Instructor Initials/Date: Skilled	Moderately Skilled
_____	a.	Perform a road test for transmission diagnosis (12)	_____	_____
_____	b.	Replace an extension housing bushing and seal (18)	_____	_____
_____	c.	Tune-up an automatic transmission (24)	_____	_____

_____ 8.	Discuss	Your competency in each task with your instructor. Your instructor will initial each task in which you demonstrate sufficient competency. If all tasks have been initialed by your instructor, proceed to Learning Step 27. Otherwise, continue to Learning Step 9.
_____ 9.	Refer	To Learning Step 7a. If this task has been initialed by your instructor, proceed to Learning Step 15. Otherwise, continue to Learning Step 10.
_____10.	Study	Job Sheet #1--Perform a Road Test for Transmission Diagnosis, page AM II-255-C.
_____11.	Watch	Slide/tape presentation, "Perform a Road Test for Transmission Diagnosis" (C-V-1).
_____12.	Do	Job Sheet #1--Perform a Road Test for Transmission Diagnosis.
_____13.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 7a and proceed to Learning Step 15. Otherwise, repeat Learning Steps 10 through 12 and then continue to Learning Step 14.
_____14.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 7a and continue to Learning Step 15. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 7a and then continue to Learning Step 15.

_____15.	Refer	To Learning Step 7b. If this task has been initialed by your instructor, proceed to Learning Step 21. Otherwise, continue to Learning Step 16.
_____16.	Study	Job Sheet #2--Replace an Extension Housing Bushing and Seal, page AM II-259-C.
_____17.	Watch	Slide/tape presentation, "Replace an Extension Housing Bushing and Seal" (C-V-2).
_____18.	Do	Job Sheet #2--Replace an Extension Housing Bushing and Seal.
_____19.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 7b and proceed to Learning Step 21. Otherwise, repeat Learning Steps 16 through 18 and then continue to Learning Step 20.
_____20.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 7b and continue to Learning Step 21. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 7b and then continue to Learning Step 21.
_____21.	Refer	To Learning Step 7c. If this task has been initialed by your instructor, proceed to Learning Step 27. Otherwise, continue to Learning Step 22.

_____22.	Study	Job Sheet #3--Tune-Up an Automatic Transmission, page AM II-263-C.
_____23.	Watch	Slide/tape presentation, "Tune-Up an Automatic Transmission" (C-V-3).
_____24.	Do	Job Sheet #3--Tune-Up an Automatic Transmission.
_____25.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 7c and proceed to Learning Step 27. Otherwise, repeat Learning Steps 22 through 24 and then continue to Learning Step 26.
_____26.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 7c and continue to Learning Step 27. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 7c and then continue to Learning Step 27.
_____27.	Review	Information Sheet, page AM II-243-C through AM II-245-C and LAP Assignment Sheets.
_____28.	Take	Automatic Transmission Service Test (see your instructor). If your score is 85 percent or above, continue to the next assigned Learning Activity Packet. Otherwise, ask your instructor about additional study requirements and possible retesting.

SECTION C--DRIVE TRAIN
UNIT V--AUTOMATIC TRANSMISSION SERVICE

PRETEST

NAME _____ SCORE _____

DIRECTIONS: Th/) pretest is to determine how much you already know about automatic transmission service. Your performance on this pretest will not be used to determine your grade in the course. Instead, it will guide your instructor in designing this course to meet your needs. If you are unsure of the answer to a question, do not guess. Guessing may prevent you from receiving needed instruction.

1. Match terms and definitions associated with automatic transmission service. Write the correct numbers in the blanks.

2	a.	Act of setting proper shift points of the transmission to vehicle speed and load	1. Band adjustment 2. Throttle linkage or modulator valve adjustment 3. Transmission tune-up 4. Selector adjustment
1	b.	Adjustment of band clearance to the drum while the band is not energized	
4	c.	Procedure for assuring the correct positioning of the manually operated hydraulic valve for desired gear range	
3	d.	Procedure involving the changing of fluid and filter and making all adjustments necessary for optimum transmission performance	

2. Select from the following list the repairs which can be performed with the transmission in the vehicle. Write an "X" in the blank before each correct answer.

x	a.	Oil pan, gasket, and filter
x	b.	Control linkage
x	c.	Servo (some models)
x	d.	Extension housing bushing and seal replacement
x	e.	Speedometer, cable, and drive gear
	f.	Band
x	g.	Governor valve

__x__ b. Valve body assembly

__x__ i. Vacuum modulator

_____ j. Clutch

3. List the items to include in an automatic transmission tune-up.

a. Change fluid

b. Change filter or pick-up screen

c. Clean oil pan

d. Adjust bands, if adjustable

e. Adjust selector linkage

f. Adjust neutral safety switch

g. Adjust throttle linkage or modulator valve, if possible

h. Check for fluid leaks

4. Match tests that are performed while transmission is in vehicle to their correct descriptions. Write the correct numbers in the blanks.

__4__ a. Tests each hydraulic circuit and compares with a standard performance value, which indicates general problems in hydraulic components

__1__ b. Indicates overall characteristics of transmission operation

__3__ c. Tests each hydraulic component individually for pressure leaks

__2__ d. Indicates the condition of torque converter operation and strength of hydraulic components

1. Road test
2. Stall test
3. Air pressure test
4. Fluid pressure test

5. Distinguish between the types of automatic transmission fluids. Write a "D" before the vehicles that use Dexron or Dexron II, and an "F" before the vehicles that use Prefix F.

__D__ a. General Motors Corporation vehicles

__F__ b. Ford Motor vehicles

D c. American Motors Corporation vehicles

D d. Chrysler Corporation vehicles

6. Describe the procedure for checking automatic transmission fluid level.

a. Clean all dirt from around dipstick and cap

b. Operate engine until transmission fluid is at normal operating temperature

c. Shift transmission through all ranges at idle with brakes applied

d. Leave engine idling in park

e. Pull and wipe dipstick; reinsert until cap bottoms on tube

f. Pull dipstick and check level of fluid; adjust fluid level as necessary

7. Match fluid conditions to their possible transmission problems. Write the correct numbers in the blanks.

3 a. Clutch or band has lost friction material

1 b. Coolant leak into transmission, engine overheating, or fluid broken down

4 c. Normal condition

2 d. Clutch or band burnt

1. Varnish on dipstick
2. Burnt, discolored
3. Solid residue in fluid
4. Clean and deep red color

8. List three types of transmission filters.

a. Fine-meshed screen

b. Paper

c. Dacron

9. Stop. Have your instructor evaluate your pretest and mark the area(s) below requiring additional study.

Refer to the Information Sheet, Sections

I _____ II _____ III _____ IV _____ V _____

VI _____ VII _____ VIII _____ IX _____

You came here from Learning Step 2. If none of the above sections are checked, proceed to Learning Step 7. Otherwise, continue to Learning Step 3.

SECTION C--DRIVE TRAIN
UNIT V--AUTOMATIC TRANSMISSION SERVICE

LAP ASSIGNMENT SHEET #1

NAME _____ SCORE _____

1. Match terms and definitions associated with automatic transmission service. Write the terms in the blanks before their definitions.

Band adjustment
Selector adjustment
Transmission tune-up
Throttle linkage or modular valve adjustment

a. Throttle linkage or modulator valve adjustment --Act of setting proper shift points of the transmission to vehicle speed and and load

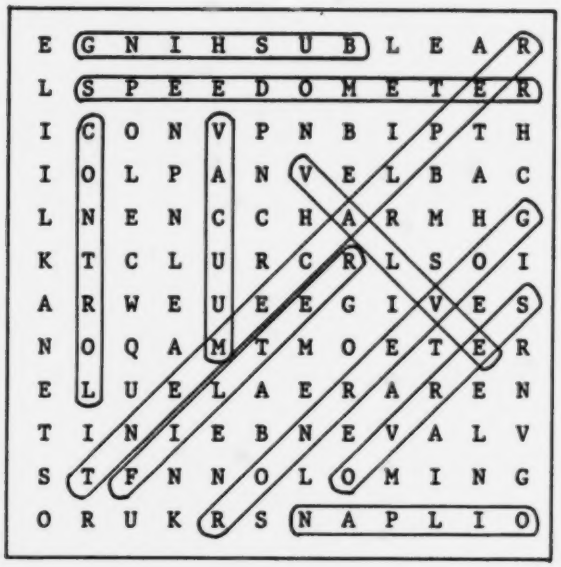
b. Band adjustment --Adjustment of band clearance to the drum while the band is not energized

c. Transmission tune-up --Procedure involving the changing of fluid and filter and making all adjustments necessary for optimum transmission performance

d. Selector adjustment --Procedure for assuring the correct positioning of the manually operated hydraulic valve for desired gear range

LAP ASSIGNMENT SHEET #1

2. Fill in the blanks to complete phrases describing repairs which can be performed with the transmission in the vehicle. Circle those words in the puzzle below.



E	G	N	I	H	S	U	B	L	E	A	R
L	S	P	E	E	D	O	M	E	T	E	R
I	C	O	N	V	P	N	B	I	P	T	H
I	O	L	P	A	N	V	E	L	B	A	C
L	N	E	N	C	C	H	A	R	M	H	G
K	T	C	L	U	R	C	R	L	S	O	I
A	R	W	E	U	E	E	G	I	V	E	S
N	O	Q	A	M	T	M	O	E	T	E	R
E	L	U	E	L	A	E	R	A	R	E	N
T	I	N	I	E	B	N	E	V	A	L	V
S	T	F	N	N	O	L	O	M	I	N	G
O	R	U	K	R	S	N	A	P	L	I	O

a. Governor valve

b. Vacuum modulator

c. Extension housing bushing and seal replacement

d. Oil pan, gasket, and filter

e. Servo (some models)

f. Control linkage

g. Valve body assembly

h. Speedometer, cable, and drive gear

3. Select terms to complete the list of items to include in an automatic transmission tune-up.

Bands	Selector linkage
Fluid leaks	Oil pan
Throttle linkage or modulator valve	Neutral safety switch
Fluid	Filter or pickup screen

a. Check for **Fluid leaks**

b. Clean **Oil pan**

c. Change

1) **Bands**

2) **Selector linkage**

d. Adjust

1) **Bands**

2) **Selector linkage**

3) **Neutral safety switch**

4) **Throttle linkage or modulator valve, if possible**

4. Name the types of tests performed while transmission is in vehicle. Write the correct names before their descriptions.

a. **Road test** --Indicates overall characteristics of transmission operation

b. **Air pressure test** --Tests each hydraulic component individually for pressure leaks

c. **Stall test** --Indicates the condition of torque converter operation and strength of hydraulic components

d. **Fluid pressure test** --Tests each hydraulic circuit and compares with a standard performance value, which indicates general problems in hydraulic components

5. Answer the following questions concerning types of automatic transmission fluids and their applications.

   a. Which types of vehicles use Dexron and Dexron II automatic transmission fluid?

      1) American Motors Corporation

      2) General Motors Corporation

      3) Chrysler Corporation

   b. Which type uses Prefix F? Ford

6. Fill in the blanks to complete statements concerning the procedure for properly checking the transmission fluid level.

   a. Clean all dirt from around dipstick and cap.

   b. Operate engine until transmission fluid is at normal operating temperature.

   c. Shift transmission through all ranges at idle with brakes applied.

   d. Leave engine idling in park.

   e. Pull and wipe dipstick; reinsert until cap bottoms on tube.

   f. Pull dipstick and check if level is between arrows or Full and Add marks; adjust fluid level as necessary.

7. Match fluid conditions to their possible transmission problems. Write the correct numbers in the blanks.

3 a.	Coolant leak into transmission, engine overheating, or fluid broken down	1. Clean and deep red color
4 b.	Clutch or band burnt	2. Solid residue in fluid
1 c.	Normal condition	3. Varnish on dipstick
2 d.	Clutch or band has lost friction material	4. Burnt, discolored

8. Select from the following list types of transmission filters. Write an "X" in the blank before each correct answer.

_____a. Nylon

__X__b. Paper

_____c. Cotton

__X__d. Fine-meshed screen

_____e. Fiberglass netting

__X__f. Dacron

9. Stop. Have your instructor evaluate your Assignment Sheet and mark the area(s) below requiring additional study.

Refer to Information Sheet, Section(s)

I _____ II _____ III _____ IV _____ V _____

VI _____ VII _____ VIII _____ IX _____

If none of the above Sections are checked, proceed to Learning Step 7. Otherwise, continue to Learning Step 6.

SECTION C--DRIVE TRAIN
UNIT V--AUTOMATIC TRANSMISSION SERVICE

LAP ASSIGNMENT SHEET #2

NAME _____ SCORE _____

1. Fill in the blanks to complete definitions of terms associated with automatic transmission service.

   a. Transmission tune-up--Procedure involving the changing of **fluid** and **filter** and making all **adjustments** necessary for optimum transmission performance.

   b. Band adjustment--Adjustment of band **clearance** to the **drum** while the band is not energized.

   c. Throttle linkage or modulator valve adjustment--Act of setting proper **shift** **points** of the transmission to vehicle **speed** and **load**.

   d. Selector adjustment--Procedure for assuring the correct positioning of the manually operated **hydraulic** **valve** for desired gear range.

2. Fill in the blanks to complete the list of repairs which can be performed with the transmission in the vehicle.

   a. Extension housing **bushing** and **seal** replacement

   b. **Valve** body assembly

   c. **Speedometer**, cable, and drive gear

   d. Servo (some models)

   e. Governor **valve**

   f. Vacuum **modulator**

g. Oil pan, gasket, and filter

h. Control linkage

3. Write in the operation to be performed, such as "check" or "change," for each of the items included in an automatic transmission tune-up.

a. Change fluid

b. Adjust bands, if adjustable

c. Check for fluid leaks

d. Adjust throttle linkage or modulator valve if possible

e. Adjust selector linkage

f. Clean oil pan

g. Clean filter or pick-up screen

h. Adjust neutral safety switch

4. Discuss tests that are performed while the transmission is in the vehicle. State what each type of test indicates.

a. Road test-- Indicates overall characteristics of transmission operation

b. Stall test-- Indicates the condition of torque converter operation and strength of hydraulic components

c. Fluid pressure test-- Indicates general problems in hydraulic components by testing each hydraulic circuit and comparing with a standard performance valve

d. Air pressure test-- Indicates pressure leaks

LAP ASSIGNMENT SHEET #2

5. State the type of automatic transmission fluid used by each type of vehicle listed below.

   a. American Motors Corporation vehicles-- Dexron and Dexron II

   b. Ford vehicles-- Prefix F

   c. General Motors Corporation vehicles-- Dexron and Dexron II

   d. Chrysler Corporation vehicles-- Dexron and Dexron II

6. State the procedure for properly checking transmission fluid level.

   a. Clean all dirt from around dipstick and cap

   b. Operate engine until transmission fluid is at normal operating temperature

   c. Shift transmission through all ranges at idle with brakes applied

   d. Leave engine idling in Park

   e. Pull and wipe dipstick; reinsert until cap bottoms on tube

   f. Pull dipstick and check if level is between arrows or Full and Add marks; adjust fluid level as necessary

7. Describe the fluid condition that results from each transmission problems listed below.

   a. Normal condition-- Clean and deep red color

   b. Clutch or band burnt-- Burnt, discolored

   c. Clutch or band has lost friction material-- Solid residue in fluid

   d. Coolant leak into transmission, engine overheating, or fluid broken down-- Varnish on dipstick

8. List the types of transmission filters.

   a. Fine-meshed screen

   b. Paper

   c. Dacron

9. Stop. Have your instructor evaluate your Assignment Sheet. If your instructor is satisfied with your progress, continue to Learning Step 7. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, continue to Learning Step 7.